M2Z Networks, Inc.

The Value of Public Interest Commitments and the Cost of Delay to American Consumers

Dr. Kostas Liopiros

Sun Fire Group LLC
Alexandria, VA 22304

Prepared for
M2Z Networks, Inc.

19 March 2007

Kostas Liopiros

Kostas Liopiros is principal and founder of the Sun Fire Group, an independent technology management consultancy based in Alexandria, VA. Dr. Liopiros has over 25 years of experience in consulting and senior management in the telecommunications, media and electronics industries, helping ensure that business and technology decisions meet strategic, operational and economic goals. In that capacity, he has advised on and was instrumental in the development and launch of new mobile satellite services, submarine cable systems, broadband wireless and the first commercial space based imaging system. He has advised clients on spectrum management, frequency planning and coordination, and licensing, and represented them before the FCC, NTIA, the Department of Commerce, and NASA. He has conducted research and provided testimony on regulatory issues in the telecommunications industry.

Previously, he served as advisor to the Secretary of Defense for Telecommunications and Command, Control and Communications Policy and Requirements. In this position, he directed senior staff in National policy and planning for telecommunications and emergency preparedness, and in Defense policy and planning for command, control and communications (C3). He had significant involvement in defense spectrum management, inter-agency preparations for ITU International Allocation Conferences, export control of sensitive technologies and other issues. He was instrumental in the development and implementation of key national policies for the protection of domestic commercial telecommunications and for the continuity of government. Previous to his government service, he was a project leader and senior member of the staff at the Institute for Defense Analyses where he directed studies on the evaluation of defense systems and technologies. He holds a Ph.D. in electrical engineering (systems and information science), an M.A. in mathematics and an M.S. in electrical engineering from Princeton University and a B.S. with highest honors in electrical engineering and mathematics from Lehigh University.

TABLE OF CONTENTS

Executive Summary

1. The M2Z Proposal Would Provide Substantial Public Benefits at the Least Cost

2. M2Z's Aggressive Deployment and National Footprint Would Generate Significant Public Benefits Through Competition and Lower Prices

3. M2Z's Commitment to Provide a Free Broadband Service Would Accelerate the Adoption of Broadband While Providing Significant Public Benefits

4. M2Z's Proposal to Provide Unrestricted Access to the Free Service Will Permit Public Safety Agencies To Develop A Commercially-based Interoperable Public Safety Network at Considerable Savings

5. M2Z's Commitment to Pay A Spectrum Usage Fee Would Generate Revenues for the Treasury and Social Benefits Through the Reduction of Taxes

6. FCC Delay or Failure to Authorize the M2Z Service Would Harm Consumers and Cause an Irrecoverable Loss of Consumer Benefits

7. The Substantial Public Benefits Of The M2Z Proposal Would Far Outweigh The Cost Of Authorizing The Service

Appendices

A. Penetration of Internet and Broadband
B. Consumer Adoption of New Products and Services

C. Forecasting the Sale of New Products and Services

D. Calculation of Consumer and Public Benefits

M2Z NETWORKS, INC.

THE VALUE OF PUBLIC INTEREST COMMITMENTS AND THE COST OF DELAY TO AMERICAN CONSUMERS

Executive Summary

M2Z Networks has announced plans to construct and operate a nationwide broadband wireless network that will provide affordable broadband service to almost all citizens and public safety entities. In exchange for the grant of an exclusive, nationwide 15-year license, M2Z will commit to a number of important and enforceable public interest obligations that promise to provide significant benefits to broadband consumers and the general public. This paper estimates the potential value of the public interest commitments and obligations of M2Z Networks' proposal. These benefits go to the heart of the Commission's goal of providing universal and affordable broadband access to all Americans[1], while also supporting the Commission's statutory mandate to promote the "safety of life and property through the use of wire and radio communication." [2]

Although Americans have adopted broadband faster than almost any other technology in history, overall penetration remains low -- many households do not have a choice of broadband access providers and some lack access to any. The problem is both availability and affordability. M2Z's aggressive commitment to cover at least 95% of the population within ten years after commencement of operations would provide a new national facilities-based competitor in the market for broadband, benefiting consumers through lower prices, better service and expanded choices from both incumbents and new entrants. In this study we estimate the benefits generated by M2Z's entry in the broadband

[1]The President has pledged to provide by 2007 basic broadband access to all Americans at an affordable price. The Commission has made this goal its top priority (see FCC Chairman Kevin Martin, "Why Every American Should Have Broadband Access," Financial Times, April 2, 2006); The Democratic "Innovation Agenda" has also a goal to guarantee affordable broadband access for every American within five years (see U.S. House of Representatives Press Release, November 15, 2005).

[2] 41 U.S.C. §151

market focusing on four major effects: competitive impact of M2Z's entry, benefits accruing to subscribers of M2Z's Free Service, benefits accruing to the public from public safety agencies access to M2Z's Free Service and, finally, benefits accruing to the public from payments of a spectrum usage fee to the U.S. Treasury. Assuming M2Z is permitted to enter the market in 2008, according to these calculations, American consumers and the public will experience average annual benefits of $3.8 billion, and aggregate consumer benefits over the 15-year term of the license would amount to $32.4 billion.

The greatest effect of M2Z's entry would be its competitive impact in the broadband market. M2Z's entry will alter the duopoly structure of the market for residential broadband access. We estimate that M2Z's entry would promote competition and result in a likely decrease in prices that would result in benefits to U.S. broadband consumers in 2008 dollars averaging about $2.7 billion per year with an aggregate value of about $25 billion.

M2Z's commitment to provide a basic level of broadband access free of monthly fees and surcharges with no minimum contract periods and bundling requirements will provide affordable broadband access to consumers who cannot afford existing offerings. This will accelerate the adoption of broadband in the U.S. furthering the goal of universal and affordable broadband access while resulting in significant savings to consumers. We estimate that the increased broadband access made possible by M2Z's Free Service would likely result in benefits to broadband consumers in 2008 dollars averaging about $620 million per year with an aggregate value of more than $5 billion.

M2Z's commitment to provide unrestricted free access to all public safety entities will benefit the general public by enabling any public safety agency to develop a low-cost, commercially based secondary data network to augment their existing public safety networks, while providing interoperability with other public safety users nationwide.

We estimate that free broadband access for public safety could result in benefits to the Public in 2008 dollars averaging about $380 million per year with an aggregate value of about $3.5 billion.

As a condition of its license, M2Z will commit to pay to the U.S. Treasury a "spectrum usage fee" of five percent (5%) of the gross revenues derived from its subscription service. This fee will generate additional unbudgeted revenue for the Treasury benefiting all taxpayers. We estimate that the fees for leasing the spectrum would likely result in benefits to the Public in 2008 dollars averaging about $32 million per year with an aggregate value of about $275 million.

The estimates of the consumer and public benefits assume that M2Z receives a spectrum license in a timely fashion enabling commencement of operations by the beginning of 2009. Clearly, any factor that delays entry would harm consumers and cause a substantial loss of benefits that cannot be recovered. We examined the effects of a one-year delay in the commencement of operations:

Aggregate Consumer Benefits Lost From Delayed Entry			
	Years Delay		**Loss**
	0	**1**	
Competition	$25.2 B	$22.1 B	$3.1 B
M2Z Free Service	$5.2 B	$4.2 B	$1.0 B
Public Safety	$3.5 B	$3.0 B	$500 M
Spectrum Fee	$275 M	$225 M	$50 M
Total	$34.2 B	$29.5 B	$4.7 B

Just one-year of delay could cost consumers and the public over $4.7 billion in lost benefits. In a dynamic and risky market such as telecommunications, policy makers need to take careful consideration of the cost of delay -- and the associated risk of failure.

1. The M2Z Proposal Would Provide Substantial Public Benefits At The Least Cost

M2Z Networks has filed an application with the Federal Communications Commission (FCC) to construct and operate a nationwide broadband[3] wireless network in 20 MHz of unpaired spectrum in the 2155-2175 MHz band.[4] In exchange for the grant of an exclusive nationwide spectrum license, M2Z will commit, as a condition of the license, to the following public interest obligations[5]:

- ***Broadband Coverage of at Least 95% of the Population Within 10 Years, After Commencement of Operations***
- ***M2Z Free Service to Anyone That Registers a Compatible Access Device***
- ***Filtering of Indecent and Obscene Material***
- ***Commitment to Public Safety and Interoperability***
- ***Five Percent Revenue-based Fee for Use of the Spectrum***

Granting M2Z's license application will result in real and substantial benefits to all Americans. As discussed in this paper, the value of these benefits over the 15-year license period would be substantial, even over a range of market assumptions.

In deciding whether to assign a spectrum license to M2Z, the FCC must strike a balance among multiple objectives.[6] Key to this process is to seek to obtain the greatest public

[3] The FCC generally defines broadband service as data transmission speeds exceeding 200 Kilobits per second (Kbps) in at least one direction: downstream (from the Internet to the user's computer) or upstream (from the user's computer to the Internet).

[4] Application For License and Authority to Provide National Broadband Radio Service In The 2155-2175 MHZ Band, Filed with the FCC, May 5, 2006. Amended on September 1, 2006, WT Docket No. 07-16 (hereinafter referred to as "*Application*")

[5] Ibid. p 12.

[6] These include ensuring efficient use of the spectrum, promoting economic opportunity and competition, avoiding excessive concentration of licenses, preventing the unjust enrichment of any party and fostering the rapid deployment of new services, as well as recovering for the public a portion of the value of the spectrum.

benefits at the least cost.[7] The cost of granting the application is the opportunity cost of the foregone revenue from auction or sale of the spectrum. Authorization of the M2Z proposal would enhance economic efficiency by maximizing the net consumer and public welfare.[8] The M2Z project should be evaluated on its net benefits – to ensure that the public benefits outweigh the costs associated with that decision.[9]

2. M2Z's Aggressive Deployment and National Footprint Would Generate Significant Public Benefits Through Competition and Lower Prices

M2Z will commit to deploy a nationwide wireless broadband network available to at least 95% of the U.S. population in 10 years, after commencement of operations. Within that footprint, M2Z will provide a basic advertising-supported M2Z Free Service direct to consumers and a subscription-based Premium Service to be sold primarily by partners as part of a bundle of services (Table 1).[10]

M2Z will implement a version of WiMax standards based technology[11] designed to support fixed and nomadic access. [12] Fixed access will be provided with a wireless

[7] Cost-benefit analyses are used extensively in government rulemaking. Executive Order (E.O.) 12866 (September 30, 1993) (amended by E.O. 13258 (February 26, 2002) and E.O. 13422 (January 18, 2007)) requires regulatory agencies to conduct cost-benefit analysis on proposed regulation to ensure that the benefits of the intended regulation justify its costs. Agencies are expected to consider both quantitative and qualitative measures of costs and benefits and then select the regulatory approach that maximizes the net benefits. For example, the FCC frequently takes into account pubic safety and public interest benefits other than monetary recovery in assigning spectrum (*see* Improving Public Safety Communications in the 800 MHz Band, Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order, FCC 04-168, (rel. August 6, 2004)).

[8] Economic efficiency is a measure of the net contribution of an activity or project to overall social welfare.

[9] Thomas W. Hazlett and Robert E. Munoz, What Really Matters in Spectrum Allocation Design, AEI-Brooking Joint Center for Regulatory Studies, Working Paper 04-16, August 2004

[10] Likely partners for resale of the Premium Service include video service providers that would include broadband access as part of a bundled package of services to compete with the bundles offered by national cable and telephone companies, Internet service providers (ISPs) and rural telephone companies (that would include nomadic broadband access to provide local and national roaming).

[11] World Interoperability for Microwave Access (WiMax) is an industry forum that certifies equipment that meets conformity and interoperability tests for the IEEE 802.16 standard. M2Z plans to use IEEE standard 802.16d (802.16-2004), which comprises fixed and nomadic profiles. The IEEE standard 802.16e (802.16-2005) comprises fixed, nomadic and mobile profiles.

broadband router, which can be used to network several computers within a residence or office.[13] Nomadic access will be provided with PCMCIA standard data cards that can be used with laptop computers, personal digital assistants (PDAs) and other portable devices designed to use such cards for wireless access.[14,15]

M2Z Network Service Offering		
	M2Z Free Service	**Premium Service**
Data Rate	384 Kbps/128 Kbps	3 Mbps/1 Mbps
Availability	At least 95 % of population	
Content Filtering	Mandatory	Optional
Mobility Class	Fixed or Nomadic	
Cost	CPE[a] only	CPE[a] plus monthly fee

[a] Consumer Premises Equipment (CPE) initially will consist of a broadband router for fixed access and PCMCIA cards for nomadic (portable) access.

Table 1. M2Z Services.

Nomadic access supports broadband communications anywhere within M2Z's coverage area when the end user or device is stationary or moving slowly at pedestrian speeds.[16] Most applications – such as e-mail, instant messaging, web browsing and voice-over-IP (VoIP) – are used mostly when the user is stationary (at various locations). A system that supports nomadic access can support broadband access for the majority of the time a user

[12] Fixed access is defined as access in which the location of the end-user CPE is fixed. Nomadic access is defined as access in which the location of the end-user CPE may be in different places and relatively stationary while in use.

[13] The wireless broadband router (residential gateway in the Application) is a dual-mode device that integrates the M2Z wireless wide-area network (WAN) with a Wi-Fi (802.11) wireless local area network (LAN). The wireless broadband router will enable one or more users in a household (or other location) to share Internet access through a wired (Ethernet or USB) connection and/or a through the wireless LAN.

[14] The PCMCIA standard card (portable gateway in the Application) -- such as a PC Card or ExpressCard – incorporates an M2Z radio. The card is inserted into the expansion slot on the side of most laptop computers, and some pocket PCs, PDAs and other portable devices.

[15] Just as built-in Wi-Fi and/or mobile wireless support is now available on many laptop computers, as the market demand for M2Z's services builds, an M2Z radio can be embedded into laptop personal computers, pocket PCs, PDAs and other portable communications devices used to access the Internet.

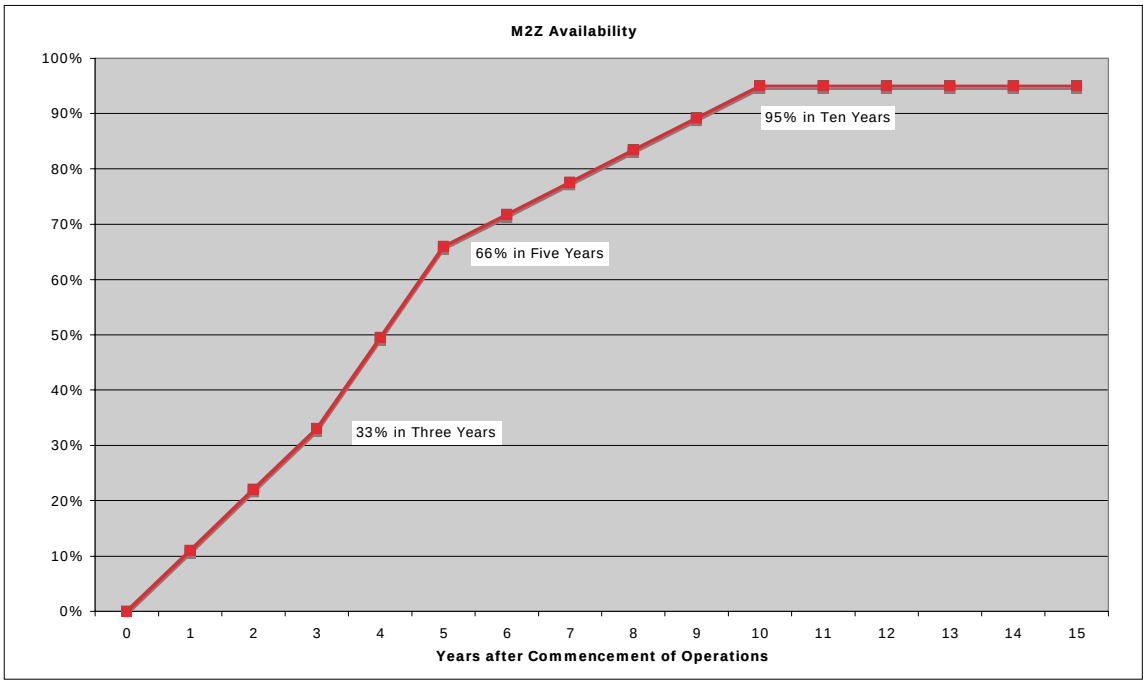
[16] The ITU-R divides wireless access into the following mobility classes: stationary (0 km/hr); pedestrian (up to 10 km/hr); typical vehicular (up to 100 km/hr); and high speed vehicular (up to 500 km/hr).

might want to have it. This provides clear value for the consumer over wireline systems such as cable modem or DSL.

The M2Z Free Service will be available to anyone that registers a compatible access device on-line and will include mandatory content filtering.[17] The M2Z Free Service will be free of airtime or service charges but will require the user to purchase compatible consumer premises equipment (CPE) to access the service. The always-on access to the Internet with a data rate of at least 384 Kbps downstream and 128 Kbps upstream (total of at least 512 Kbps) is greater than that achievable with a dial-up modem[18] and some basic DSL offerings.[19] The Premium Service will provide a higher data rate of 3.0 Mbps downstream and 1.0 Mbps upstream, which is competitive with consumer wireline broadband services (e.g. DSL and cable modem) and wireless broadband services.

M2Z availability. The availability of M2Z Free and Premium Services will be determined by the rate of deployment of the M2Z network. The deployment benchmarks in the Application require M2Z to construct sufficient base stations to cover: 33% of the U.S. population by the *third anniversary of commencement of operations;* 66% of the U.S. population by the *fifth anniversary of commencement of operations;* and 95% of the U.S. population by the *tenth anniversary of commencement of operations.*[20] The availability curve in Figure 1 below is constructed by interpolating the benchmarks with straight-line segments. We assume that deployment levels off at 95% after year 10, although deployment could continue above 95% of the population depending upon the future availability of backhaul infrastructure.

[17] Mandatory content filtering is considered necessary since the M2Z Free Service will not require billing information or other information that can be used to verify the age of a subscriber.
[18] Modern dial-up modems typically have maximum theoretical speeds of 56 Kbps (V.92 protocol), although in most cases only 53 Kbps downstream for receiving and 31.2 Kbps upstream for transmitting is achievable due to FCC regulations that limit the transmit power of dial-up modems to 12 dBm.
[19] E.g. several basic DSL offerings provide a data rate of 256 Kbps downstream and 256 Kbps upstream for about $20 per month.
[20] Supra note 3.



Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Available	0.0%	11.0%	22.0%	***33.0%***	49.5%	***66.0%***	71.8%	77.6%	83.4%	89.2%	***95.0%***	95.0%	95.0%	95.0%	95.0%	95.0%

Figure 1. M2Z Availability

Although the deployment of the M2Z network will determine the availability of M2Z services, consumers will not necessarily take up M2Z services the instant they become available. We expect that the consumer adoption of M2Z services will follow a classic s-shaped adoption curve. We have modeled the M2Z adoption curve on the historical adoption data of television and broadband (Appendix B).

Residential broadband availability. The U.S. broadband market is characterized by limited competition and incomplete coverage. The Congressional Research Service (CRS) described it recently as a "cable and telephone broadband duopoly."[21] This assessment is supported in recent reports by the General Accountability Office (GAO)[22]

[21] "Access to Broadband Networks," Congressional Research Service Report for Congress, June 28, 2006.
[22] Broadband Deployment is Extensive throughout the United States, but It's Difficult to Assess the Extent of Deployment Gaps in Rural Areas, United States Government Accountability Office, GAO-06-426, May 2006

and the Congressional Budget Office (CBO).[23] The latest FCC data on broadband shows that in the first half of 2006, the U.S. had about 65 million high-speed lines (with at least one direction greater than 200 Kbps), 80% of which were provided by telephone companies using digital subscriber line (DSL) technology and by cable companies using cable modem technology.[24] The concentration is considerably greater in the residential market where in the first half of 2006 over 95% of the 50 million residential high-speed lines were provided by telephone and cable companies – 20.2 million or 40.3% were DSL lines (primarily asymmetric digital subscriber (ADSL)) and 27.7 million or 55.2% were cable modem lines.[25] Although broadband growth in the U.S. has been steady -- it has taken over seven years to reach 44% penetration of U.S. households (by the first half of 2006).[26] Cable modem and DSL services are available primarily in large metropolitan and suburban areas and less in rural areas. In many rural areas only a single broadband provider is available, and nearly one-tenth of all households lack affordable broadband services.[27,28]

Cable modem service is available to over 99 million households (about 89% of all U.S. households).[29] The overall availability of DSL services is considerably less, even though telephone service is available to over 95% of the households in the U.S. OECD estimates that 84% percent of U.S. telephone lines are DSL *capable*.[30] However, unlike cable modem, DSL performance is sensitive to the length and gauge of the line between the customer's premises and the DSL equipment, which is normally located at the

[23] "Does the Residential Broadband Market Need Fixing?" Congressional Budget Office, 2003.
[24] "High Speed Services for Internet Access: Status as of June 30, 2006" January 2007, Table 1.
[25] Ibid, Table 3. See also appendix A for a compilation of FCC data on residential high-speed lines through the middle of 2006.
[26] Ibid.
[27] "A Nation On-line: Entering the Broadband Age," U.S. Department of Commerce, September 2004.
[28] Supra note 20.
[29] FCC Form 325 data for 2004 indicates that more than 93% of homes passed by cable have access to high-speed Internet service. At the end of 2004, cable systems passed 108.6 M occupied homes (not all with a television). Thus, according to the FCC data, cable modem service was available to about 99 M households at the end of 2004. According to the U.S. Census data, there were about 111 M households at the end of 2004, which means that the overall availability of cable modem service was about 89.4% of households. (12th Annual Report to Congress on Video Competition, FCC 06-11 (March 3, 2006), pp 30-31.
[30] OECD Communications Outlook 2005, Organization for Economic Cooperation and Development.

telephone company central office (CO).[31] Current DSL technologies work at loop lengths up to about 12,000 feet to 18,000 feet, depending upon the wire gauge.[32] For example, if a customer is located 18,000 feet from the CO and the local loop consists entirely of thinner 26-gauge wire, it is unlikely that DSL service would be available. The telephone companies are reducing loop length in many areas by deploying remote terminals.[33] This will bring more -- but not all -- subscribers within the 12,000 to 18,000 foot line length limitation.

The availability of wireline broadband service may not improve. Both the incumbent local telephone company and the local cable company deliver broadband services over existing and costly wired networks that were designed and built originally for a different purpose. The cost of upgrading pre-existing cable or telephone network to also provide broadband access can be substantial. Wireline broadband networks require large up-front fixed capital expenses which means that the cost of deploying DSL and cable modem increases as the population density decreases. Adding DSL capable lines becomes increasingly unfeasible and uneconomical for smaller and more isolated markets. As a result, the larger carriers have focused on more densely populated urban and suburban areas – rather than less densely populated rural areas.

Because of differences in the technologies and the limitations of the telephone local loop, cable modem service typically offers higher data rates and is often priced at a

[31] The telephone company local loop twisted pair cable uses 24AWG (American Wire Gauge) or 26AWG wire. Typically the distance supported for 26AWG is only about two-thirds of the distance supported by 24AWG. As reported by Bellcore, approximately 88% of loops are less than 18,000 feet and 65% comply with carrier service area design rules -- requirements that prescribe loop lengths of less than 12,000 feet for 24AWG and less than 9,000 feet for 26AWG.

[32] The achievable DSL speed depends upon both the loop length and the wire gauge. For example, rate adaptive ADSL (RADSL) can achieve 1.5 Mbps downlink/384 Kbps uplink at 18,000 feet loop length and 24AWG wire -- but only at 5,500 feet when the wire gauge is 26AWG. RADSL can achieve 7 Mbps downlink/1.5 Mbps uplink at 6,000 feet with 24AWG but only 1,800 feet with 26AWG. However, many loops consist of both gauges and it is difficult to determine what % of the loop plant is of uniform gauge. (IEC: Digital Subscriber Line (DSL) Testing)

[33] A remote terminal is generally any type of switching or routing equipment located outside of the traditional central office that is linked back to the central office. DSL capable remote terminals have been implemented to overcome the 18,000-foot DSL limitation. The objective is to put the DSL equipment (DSL access multiplexer (DSLAM)) closer to the subscriber. However, some subscribers can still be located too far from the remote terminal for DSL service.

premium to DSL.[34] Reported prices for residential Internet access as of December 2005 are shown in Table 2.[35,36] The weighted average of residential broadband service can be calculated to be $37.30 per month -- about $18 more than the average cost of dial-up. [37]

Average Monthly Bills for Internet Access	
Cable Modem	$41
DSL	$32
Dial-up	$18

Table 2. Average monthly cost of Internet Access (December 2005)

Benefits of competition. Introduction of M2Z Free and Premium Services will increase the level of broadband competition in the U.S. The Premium Service specifically will enable new entrants to offer service bundles to compete with incumbent cable and telephone operators. M2Z's commitment to pass at least 95% of the population within ten years after commencement of operations will accelerate broadband competition in most areas of the country, including many areas that have no affordable broadband providers.[38] As in other markets where consumers are given a choice of multiple providers – prices can drop rapidly and significantly. We consider examples from the video and mobile wireless markets that illustrate the effectiveness of facilities-based

[34] According to the Center for Media Research, in December 2006, 85% of cable broadband lines had speeds of over 2.5 Mbps in the fastest direction, compared to 14% of DSL lines.

[35] According to the PEW/Internet and American Life Project, in December 2005, Internet users reported the following average bills for service: $18 for dial-up; $32 for DSL and $41 for cable modem.

[36] It should be noted that these prices do not include the cost of CPE and installation charges and, in many cases, reflect a discount for a bundle of services sold by the cable companies and telephone companies. The bundling requirements of telephone and cable companies make the cost of subscribing to broadband much more expensive and less affordable. For example, cable companies typically price cable modem service about $52 per month (plus installation) -- and discount it to $42 per month if video service is also included in the package. Telephone companies, on the other hand, may require a subscriber to also subscribe to telephone service before providing DSL service.

[37] At the end of 2005 there were about 25.6 M cable modem lines and about 19.5 M ADSL lines, so the weighted average of broadband service would be $37.30 per month.

[38] Although satellite broadband is available in the uncovered areas (subject to line-of-sight restrictions) it cannot be considered an affordable alternative. For example, two-way satellite broadband at 512 Kbps downlink and 128 Kbps uplink is available from Wild Blue at about $50 per month, with an equipment cost of $300 plus installation charges. Higher speeds are available at monthly rates of $70 to $80.

competition. Table 3 summarizes the analyses of price declines in the video and mobile wireless markets.

Price Declines due to Competition		
Entrant	**Incumbent**	**Price Decline**
Cable (Video)	Cable (Video)	15%
Telco (Video)	Cable (Video)	28% - 42%
PCS	Cellular	15% - 34%

Table 3. Examples of Price Declines due to Competition

The first example shows the effect of competition from a facilities-based cable overbuilder on incumbent cable video prices.[39] The FCC review of cable video price data concluded recently that the presence of a second cable operator in a market results in rates approximately 15 percent lower than in areas without competition.[40] Further, a series of studies by the GAO from 2002 through 2005 have shown that cable video price decreases of 15 percent or more are common in markets where there is direct competition from a second cable company (overbuilder).[41] In a separate analysis in 2006, the FCC

[39] A cable overbuilder is a company that constructs facilities in a cable companies operating area and offers competing services. Most cable overbuilders in the U.S. use advanced fiber-optic networks. The FCC now classifies overbuilders as broadband service providers (BSPs).

[40] Local Franchising Report and Order, Federal Communications Commission, Media Bureau Docket 05-311, (rel. March 5, 2007) p. 26.

[41] GAO analysis of cable pricing data shows that cable video price declines on average by 16% in areas where an overbuilder introduces service (see "Direct Broadcast Satellite Subscribership Has Grown Rapidly, but Varies across Different Types of Markets," United States Government Accountability Office, GAO-05-257, April 2005, Appendix III); In 2004 the GAO found that in the 6 markets they examined in depth, cable rates in 5 of the 6 markets were 15 to 41 percent lower than similar markets without wire-based competition in 2003 (see "Subscriber Rates and Competition in the Cable Television Industry," United States Government Accountability Office, GAO-04-262T, March 2004, p. 2); In 2003, the GAO noted that cable rates are about 15 percent lower in markets where wireline competition is present (see "Issues Related to Competition and Subscriber rates in the Cable Television Industry," United States Government Accountability Office, GAO-04-8, October 2003, p.3); GAO also noted in 2002 that the presence of a second cable franchisee (known as an overbuilder) does appear to constrain cable prices. In franchise areas without a second cable provider cable prices are approximately 17% lower than in comparable areas without a second cable provider (see "Issues in Providing Cable and Satellite Television Service," United States Government Accountability Office, GAO-03-130, October 2002).

noted that the average monthly rate for cable service was 17% lower and decreases substantially when wireline cable competition is present.[42]

The second example shows the effect of competition from telephone company (telco) video services – specifically the introduction of Verizon's fiber-to-the-home Fiber Optic Service (FiOS) -- on incumbent cable video prices. A 2006 survey by Bank of America found substantially greater price declines in cable (and satellite) video prices, on the order of 28% to 42%, as the result of new wireline video competition from traditional telecommunications carriers.[43]

The third example shows the effect on prices from the introduction of new mobile wireless services on incumbent cellular service providers. Prior to the first broadband PCS auctions in 1995, the U.S. cellular market was a duopoly. Cellular prices were relatively stable (and high) from the initiation of service in the mid 1980s -- with the average price of service, in nominal terms, exhibiting a mild downward trend. After PCS entry, prices fell and usage increased.[44] The first PCS auction (A and B Block) was concluded in 1995 -- and the final (D, E and F Block) in 1997. New PCS systems did not enter the market in force until about 1998 or later. Analysis of U.S. wireless telephone pricing data from 1997 through 2002 shows that the cost per minute declined about 16 percent from 1997 to 1998 and 27% from 1998 to 1999. Overall, the price per minute declined from 1997 to 2002 by a compound annual growth rate of almost 23 percent.[45] FCC analysis of mobile telephone price data and independent studies show that price reductions of 15 percent to 34 percent (after adjusting for efficiency gains) can be

---

[42] "Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming," Twelfth Annual Report, FCC, rel. March 3, 2006 and FCC 2005 Cable Price Survey.

[43] See David W. Barden, et.al. "Battle for the Bundle," Bank of America, Equity Research, Wireline and Wireless Telecomm Services, January 23, 2006, p.10.

[44] Thomas W. Hazlett, "Is Federal Preemption Efficient in Cellular Phone Regulation?" Federal Communications Law Journal, Volume 56, No.1, December 2003

[45] Ibid. Hazlet calculates the average cost per minute using survey data from the Cellular Telecommunications and Internet Association (CTIA). An analysis of the cost per minute data in Table 3 shows that the following decline in average price per minute: 15.9% from 1997-1998; 27.0% from 1998-1999; 26.0% from 1999-2000; 30.0% from 2000-2001; 14.3% from2001-2002. The CAGR from 1997-2002 is 22.9%

attributed to the introduction of PCS competition in the cellular wireless telephone market.[46]

Competitive response such as price reductions (and improved quality and service) can be very targeted, as incumbents can reduce prices or improve service in areas where competition is present, but keep prices high in less competitive areas. Consumer benefits[47], in the form of savings from lower prices and/or increased quality, will increase as the competing network is built out -- the more homes and population passed, the greater the aggregate savings.

Consumer benefits. We estimate the benefits flowing to incumbent broadband subscribers (i.e. not M2Z subscribers) by assuming that M2Z's entry into the local broadband market will cause broadband competitors to reduce the price of their service offerings and/or improve the quality of their service (e.g. by increasing the data rates offered). We calculate the increase in consumer welfare in any year as the product of: (1) the savings per incumbent broadband line; and (2) the average number of incumbent broadband subscribers passed by M2Z.[48]

We estimate the consumer benefits over the 15-year license term, assuming that M2Z is awarded a license no later than the beginning of year (BOY) 2008 and commences

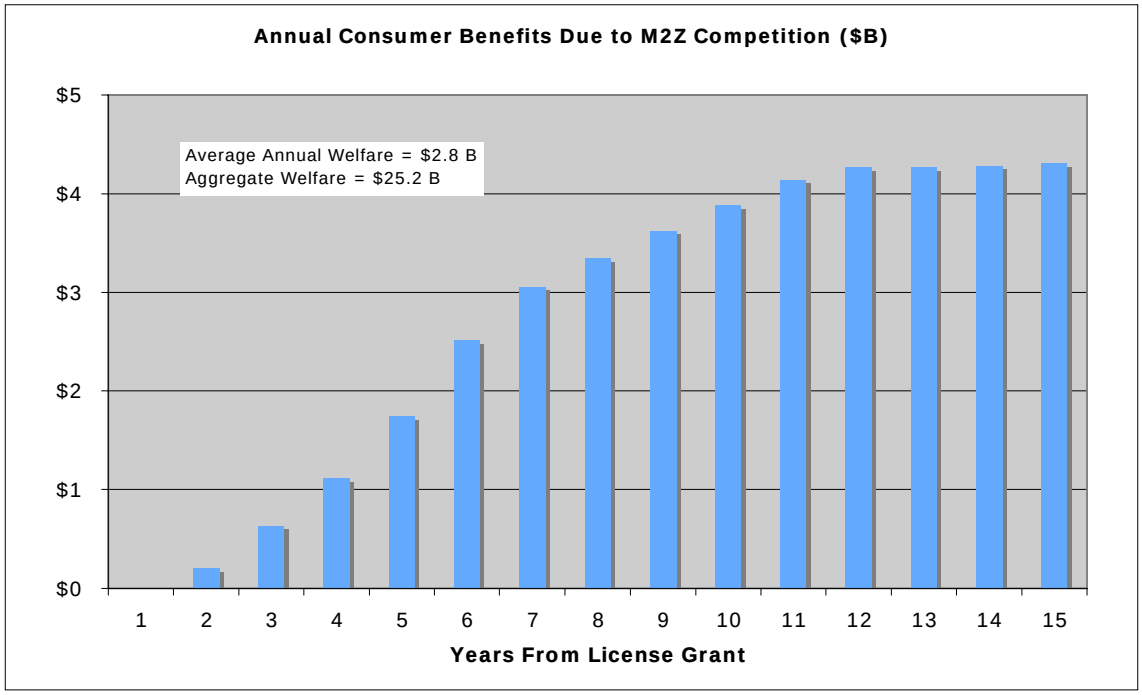
[46] The FCC quotes one study, released in April 1997 that noted that markets with one or more broadband PCS operators have combined rates for cellular and broadband PCS between 15 and 18 percent below the cellular rates in markets with no broadband PCS operators. A series of quarterly surveys for 1997 found that prices have dropped between 15 percent and 34 percent, much of which was due to cellular operators lowering their prices in response to broadband PCS operators (see Federal Communications Commission, Third Annual CMRS Competition Report, (rel.) June 11, 1998); FCC review of studies and analysis of price data from 1997 to 1998 shows that price reduction of 18 percent in the average price per minute and a price decline of aver 20 percent for high usage plans (e.g. 600 minutes) (see Federal Communications Commission, Fourth Annual CMRS Competition Report, (rel.) June 24, 1999); FCC review of studies and analysis of price data from 1998 to 1999 shows that price reductions of 11 percent to 20 percent (after adjusting for efficiency gains) have been attributed to the introduction of PCS competition in the cellular wireless telephone market (see Federal Communications Commission, Annual Report and Analysis of Competition Market Conditions with respect to Commercial Mobile Services – Fifth Report, FCC 00-289 (August 18, 2000) p6, pp14-20.

[47] The value of consumer benefits in the form of savings is less than the consumer surplus, defined as the amount by which consumers value a product over and above what they pay for it (i.e. the excess of a consumer's willingness to pay over the actual amount paid) (see The Economist: Dictionary of Economics, John Wiley and Sons, Inc., 1998, p74).

[48] Supra note 18 and accompanying text.

operation by the BOY 2009.[49] We estimate approximately 74 M broadband households (residences) in the U.S at the start of operations.[50] We project that the entire residential broadband market will grow to ultimately reach 85% of all households, i.e. about 119 million broadband households by 2023, the end of M2Z's license term. (This would include incumbent broadband providers as well as M2Z). We hold constant the average monthly broadband subscription price of $32 for DSL service and $41 for cable modem service (see Table 2) and assume that M2Z's entry will result in an average price decline of about 10% -- a conservative estimate given the data on observed price reductions in Table 3. The annual flow of consumer benefits is as shown in Figure 2.[51]

Figure 2. Consumer Benefits Due to M2Z Competition



Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	$0.0	$0.2	$0.6	$1.1	$1.7	$2.5	$3.1	$3.4	$3.6	$3.9	$4.1	$4.3	$4.3	$4.3	$4.3

[49] Based on M2Z's filing in may 2006 (Application), we believe that a license could be granted in 2007, thus enabling commencement of operations by the BOY 2009.
[50] Appendix A presents the data on Internet and broadband household penetration and projections.
[51] Appendix D presents the details of the calculations underlying the analysis.

The average annual benefit over the 15-year license term is about $2.8 billion per year. We calculate the value of the aggregate benefits by the net present value (NPV)[52] of the flow of annual benefits over the 15-year license term -- about $25.2 billion.[53]

For simplicity we have considered only the effect of M2Z's entry on the price of broadband access. We have not considered the benefits accruing to new consumers entering the broadband market due to falling prices. In addition, M2Z's entry into the residential broadband market may result in competitors upgrading their existing broadband networks and improving network quality and speed and customer service. For these reasons, the consumer benefits from M2Z's entry would be even greater than our estimate.

Sensitivity to the assumed price reduction. We examine the sensitivity of the consumer benefits to the assumed reduction in broadband prices. Based on the range of observed price reductions in Table 3, we consider a conservative low case of 5% with an optimistic high case of 15%. Table 4 presents the annual and aggregate benefits for these cases -- with the nominal case (10%) highlighted in bold.

Sensitivity to Assumed Reduction			
	5%	**10%**	15%
Average Annual Benefit	$1.4 B	**$2.7 B**	$4.1 B
NPV of Aggregate Benefits	$12.5 B	**$25.0 B**	$37.5 B

Table 4. Sensitivity of Consumer Benefits to Assumed Price Reduction

[52] We calculate the present value over the 15-year license term and we treat post-license benefits as zero by not computing a terminal value. Since we assume that the license is granted by BOY 2008, the value of the benefits is expressed in 2008 dollars.

[53] The net present value is calculated using the OMB recommended discount rate for social projects. *See* OMB Circular No. A-94, APPENDIX C (Revised January 2007). As recommended, we use 5.05%, the average of the recommended 10-year rate (5.0%) and the recommended 20-year (5.1%) rate. The rate is a nominal rate (i.e. not adjusted for inflation).

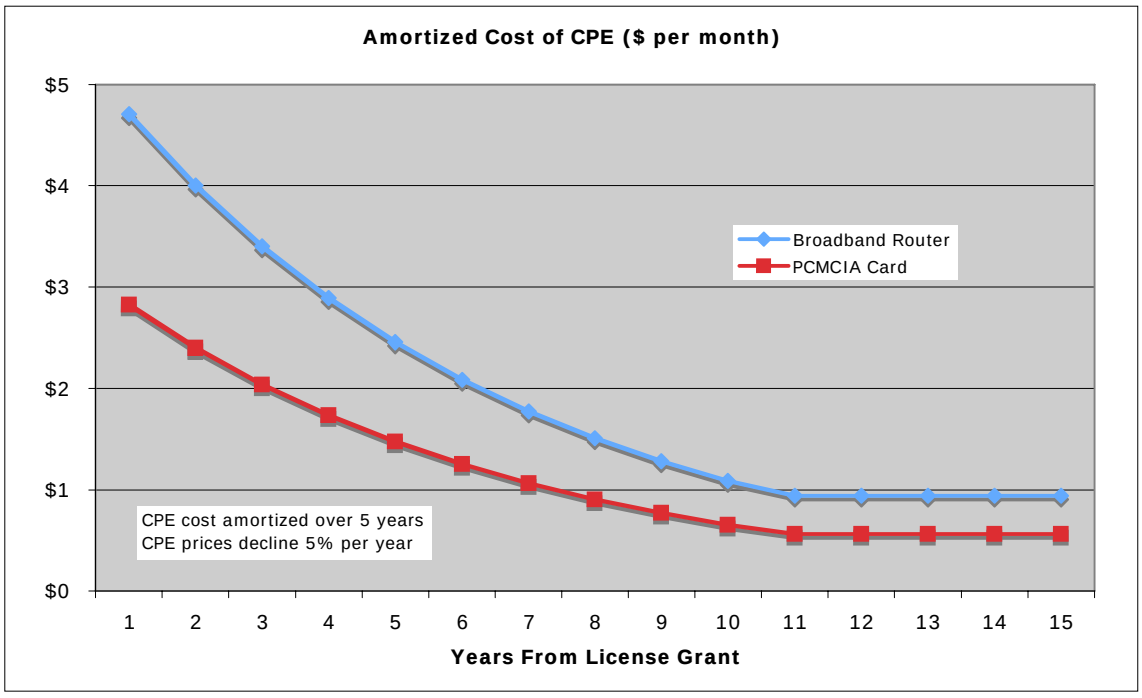
3. M2Z's Commitment to Provide a Free Broadband Service Would Accelerate the Adoption of Broadband While Providing Significant Public Benefits

High monthly fees, surcharges, minimum contract periods and bundling requirements remain an obstacle to adopting broadband connectivity to the Internet. As a result, most price sensitive consumers resort to dial-up access to the Internet. The M2Z Free Service will provide a basic level of broadband access to consumers who cannot afford existing broadband offerings and to consumers that value broadband access at less that the going market rates. [54] The service will be free of airtime or service charges and will include mandatory network filtering of indecent content at no additional cost.[55] However, the user will have to purchase a compatible CPE in order to access the service.

Cost. M2Z compatible CPE are assumed to cost no more than $250 for the broadband router and $150 for the PCMCIA data card at the BOY 2009 when M2Z is assumed to commence operations.[56] The initial cost of the CPE is on the order of the average cost of dial-up service for one year. The decision to subscribe to the M2Z Free Service is in many cases related to the long-term cost of ownership rather than the instant cost. Amortized over five years the cost is about $4.70 per month for the broadband router and about $2.80 per month for the PCMCIA data card. [57] (Compare to $18 per month average cost of dial-up).[58]

[54] Supra note 20. The GAO Report states that the price of broadband access and not necessarily the lack of a home computer is the key barrier to broadband adoption by low-income households.
[55] Filtering will be accomplished by routing M2Z Free Service traffic through a set of proxy servers using filters to inspect the traffic and restrict access as required. This approach is similar to firewalls used by large-scale enterprises to restrict user access to indecent material.
[56] M2Z projects the initial cost of the residential gateway – a wireless broadband router – to be about $250 when M2Z begins service. Wireless broadband routers are now available (November 2006) for about $250. Wireless PCMCIA data cards currently are priced at about $180 or less and many are provided free with a service plan.
[57] The amortized cost is calculated using the OMB recommended discount rate for five years (4.9%). See OMB Circular No. A-94, Appendix C (Revised 2007).
[58] Supra note 33.

These prices are expected to decline rapidly due to economies of scale as more consumers adopt wireless broadband services. The expected annual decline of CPE prices is estimated using a producer price index (PPI). Based on historical PPIs for similar equipment, we expect the price of the CPE to decline at least 15% per year.[59,60] Figure 3 following shows the decline of the five-year amortized CPE cost, assuming a 15% price decline per year. Because of the relatively higher cost of the CPE at the beginning of operations, adoption of the M2Z Free Service may be initially lower, accelerating over time as CPE costs decline. This is reflected in the s-shape of the M2Zconsumer adoption curve (Appendix B).



Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
router	$4.71	$4.00	$3.40	$2.89	$2.46	$2.09	$1.78	$1.51	$1.28	$1.09	$0.94	$0.94	$0.94	$0.94	$0.94
pcmcia	$2.82	$2.40	$2.04	$1.73	$1.47	$1.25	$1.07	$0.91	$0.77	$0.65	$0.56	$0.56	$0.56	$0.56	$0.56

Figure 3. CPE cost amortized over five years

[59] For example, annual rates of decline for price indexes for computers and peripherals has averaged about 22.2%; for routers about 13.6%, for LAN cards and equipment about 18%. (See for example: "The Need For Better Price Indices For Communications Investment," Congressional Budget Office, June 2001; Mark Doms, "Communications Equipment: What Has Happened To Prices?', Federal Reserve Bank of San Francisco Working Paper 2003-15, June 2003; Mark Doms, "Prices For Local Area Network Equipment," Federal Reserve Bank of San Francisco Working Paper 2003-13, June 2003.

[60] Since we don't expect CPE prices to decline ad infinitum, we limit the minimum selling price of the router to $50.00 and of the PCMCIA card to $30.00. For a 15% annual decrease, these lower limits are reached in about 11 years.

Market. At the end of 2005, we estimate about 81 million Internet households in the U.S. and about 43 million broadband households. The difference -- about 38 million households -- have a narrowband connection to the Internet -- primarily dial-up.[61] National surveys estimate that 35% - 60% of dial-up users intend to remain with dial-up connections rather than adopt broadband.[62,63] According to the GAO, the price of broadband access is a key barrier to broadband adoption.[64,65] These data are based on surveys of individual Internet users -- we estimate that on average of about 48% of dial-up households plan to remain with dial-up, rather than upgrade to broadband. We estimate that this represents about 22% of Internet households in 2005. Since few new Internet users adopt with broadband, we expect that this percentage will remain constant or increase as Internet penetration increases.[66] We expect these price sensitive users to continue with dial-up access until a more affordable alternative becomes available. Based on this ratio, we estimate about 21 million price sensitive users at the BOY 2009 -- growing to about 29 million at the end of M2Z's license term.

M2Z may not be the sole provider of low-cost or free broadband service. Many municipal Wi-Fi networks[67] plan to offer subsidized Internet access to low income households at a cost just above the amortized cost of the M2Z Free Service. [68] In

[61] We define "narrowband" household as a households with Internet access but no high-speed connection . This segment consists largely of users with dial-up access, but may also include users with ISDN and DSL and cable modem connections that do not meet the FCC definition of high speed (i.e. at least one direction greater than 200 Kbps.)

[62] Ipso Insight has estimated in 2005 that about 35% of dial-up users at that time planned to remain with dial-up, while 28% planned to trade-up to cable modem and 27% to DSL, with 9% not sure.

[63]The PEW/Internet estimates that 60% of dial-up users at home are not interested in changing to broadband. ("Home Broadband Adoption 2006, PEW/Internet and American Life Project, 28 May 2006).

[64] Supra note 52 and accompanying text.

[65] There are several reasons for not wanting to upgrade. According to PEW/Internet, 22% of dial-up users who say they do not want to change to broadband at home have high-speed connections at work and 45% have lower incomes than the average Internet user.

[66] Supra note 61.

[67] According to muniwireless.com, as of September 2006, there were 68 region-wide or city-wide Wi-Fi networks. This is in addition to 43 city hot-zones and 35 municipal or public safety use only networks not available to consumers. In addition, 135 municipal networks are in the planning or construction stage.

[68] For example, the municipal Wi-Fi systems under construction in San Francisco, Philadelphia, Pasadena and Alexandria are proposing monthly subscription fees of about $22 per month, with some systems charging low-income households (e.g. less than $13,000 per year) $10 per month. Unlimited national

addition, some municipal Wi-Fi developments are proposing to offer free access. Municipal Wi-Fi may also provide an affordable alternative to cable and DSL -- but the combined availability and coverage of free or subsidized service from Municipal Wi-Fi systems is not likely to be comparable with national coverage and availability of M2Z.

In addition, it is likely that one or more existing or future broadband providers could adopt M2Z's business plan and provide an advertising supported free service in addition to Paid subscription service. An existing wireless broadband provider could introduce a comparable advertising-supported free service in addition to their established paid subscription service. It is also possible that a new national wireless competitor would emerge with a similar business plan – offering both a free and a paid subscription service. Taking potential competition into account, we estimate that within the 15-year license term the M2Z Free Service could garner a share of about one-third of the 29 million price-sensitive users -- or about 9.7 million subscribers.

In addition to fixed residential access, the M2Z Free Service could also provide free nomadic access to consumers who use their laptop computers outside the home. Most consumers do not use laptops for Internet access outside the home, mainly due to the cost of access -- most nomadic use of computers is enterprise or business related.[69] In 2005, approximately 20% of Internet users used public Wi-Fi networks[70] but most consumers use Wi-Fi hot spots only when they are free.[71] Consumers are purchasing more laptops that desktop computers and more than 50% of new laptop computers now incorporate Wi-Fi. [72,73] We expect consumer demand for nomadic Internet access to continue to

---

plans, such as those offered by T-Mobile, cost about $30 per month with a one-year commitment or $40 per month with no commitment. A one-day pass (24 hours of usage) costs $10 and a one-hour pass costs $6.

[69] A 2006 survey by Toshiba shows that only a handful of consumers use a laptop to go on-line when outside the home: 11% used laptops in hotels, 7% on trains and 3% in coffee shops, and 55% used them mostly at home. The survey found that 15% thought that there were not enough wireless locations for them to use.

[70] Supra note 60.

[71] "Public Wi-Fi: Capturing Paying Customers in an Increasingly Competitive Space," Jupiter Research, March 23, 2006.

[72] In January 2005, fully 36% of household computer users said at least one computer at home was a laptop; half of these laptops were equipped with wireless modems. (PEW/INTERNET and American Life Project).

increase. The parallel development of mobile broadband devices and systems will present additional opportunities for a cheaper and more ubiquitous nomadic broadband service. However, is not clear to what extent consumers will adopt portable or mobile broadband services in any number in the future.

C**onsumer benefits.** Consumers would benefit from the M2Z Free Service by not having to pay for access and for content filtering.[74] However, the consumer will have a one-time cost of the CPE, such as a broadband router or wireless data card. The consumer benefits is calculated as the product of: (1) the avoided cost of dial-up service; and (2) the number of consumers that subscribe to the M2Z Free Service. The number of consumers that adopt the Free Service is the product of the 9.7 million ultimate market and the M2Z adoption curve. We include the cost for a consumer to subscribe, which is the cost of the CPE. We also include the one-time benefit of the avoided cost of content filtering software.

We estimate the benefits flowing to consumers that adopt the Free Service over the 15-year license term.[75] We hold constant the avoided cost of dial-up service of $16 per month. To arrive at this figure, we reduce the average monthly cost of $18 (the average cost at the end of 2005) by 10% as a result of M2Z's entry into the market.[76,77] The one-time avoided cost of content filtering software is estimated at $30.00 and declined using a 15 percent PPI.[78] The estimated annual flow of consumer benefits is shown in Figure 4.

---

[73] A report from Strategy Analytics "Wireless Connectivity Options Beyond Cellular: WLAN and Notebook PCs," concludes that by 2008 90% of notebook PCs sold worldwide will contain embedded WLAN, to reach an installed worldwide base of 141 M WLAN connected laptop computers.

[74] Parental controls, anti-spam and other services may be provided by some dial-up service as part of a basic package, but more capable network-based content filtering is not included. Some ISPs provide network-based content filtering as part of a package of services for an additional monthly fee. Alternatively, a consumer may purchase and install a client level content filtering software package.

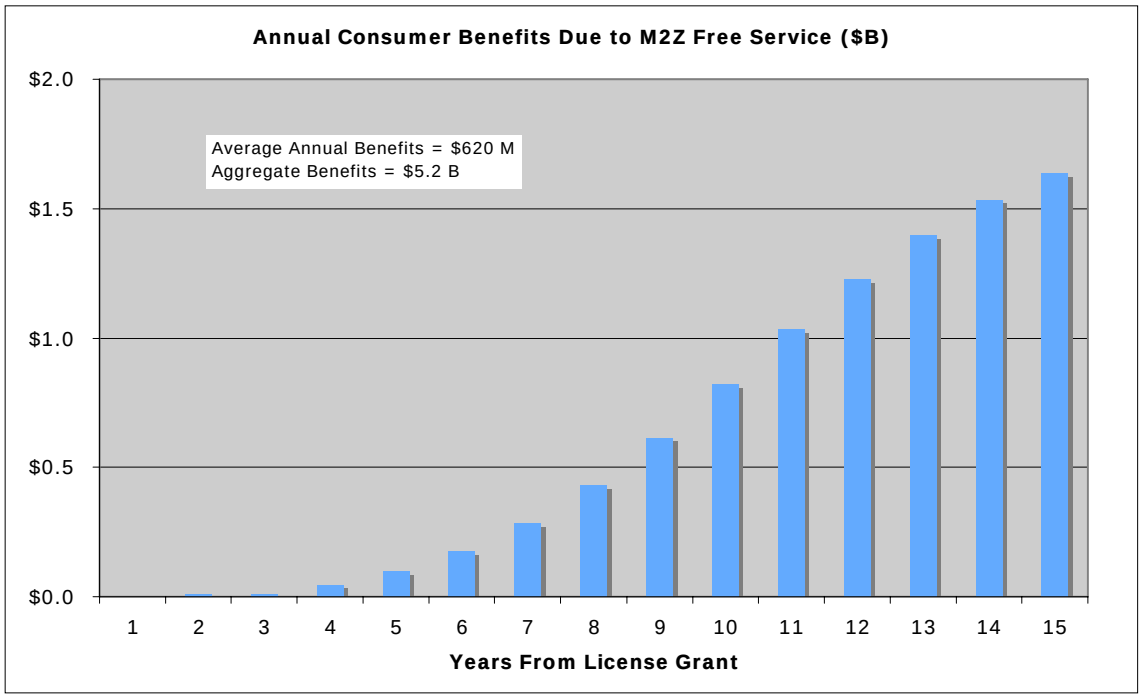
[75] Supra note 47 and accompanying text.

[76] Supra note 33 and accompanying text.

[77] We assume that dial-up service providers would also reduce the price of their services as lower end DSL service providers reduce prices to compete with M2Z.

[78] Supra note 57 and accompanying text.

The consumer benefits grow as the network is deployed and consumers adopt the M2Z Free Service. As expected, adoption initially is low and benefits in the first few years are slightly negative due to the upfront investment required in CPE. As the network is built out and adoption increases, the savings in access fees soon overtake the cost of CPE, which is declining over time. The average annual benefits over the 15-year license term are about $620 million per year. The NPV of the aggregate welfare is about $5.2 billion.[79]



Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	$0.0	($0.0)	$0.0	$0.0	$0.1	$0.2	$0.3	$0.4	$0.6	$0.8	$1.0	$1.2	$1.4	$1.5	$1.6

Figure 4. Consumer Benefits of M2Z Free Service

For simplicity and to derive a conservative estimate, we have considered only the avoided cost of dial-up service. We have not considered the value to many consumers of the greater speed and always on capability of the M2Z Free Service over dial-up. We also do not consider the potential savings that would accrue to nomadic users who could adopt the M2Z Free Service to save the cost of dial-up or Wi-Fi subscriptions. We also have

[79] Supra note 50.

not considered that subscribers for whom even dial-up access was too expensive may now enter the market. We also do not consider possibility of broadband subscribers switching to the M2Z Free Service on the basis of cost. For all these reasons, the consumer benefits from M2Z's Free Service would be even greater than our estimate.

Sensitivity to number of fixed subscribers. We examine the sensitivity of the above analysis to the number of fixed subscribers. We consider a conservative lower case of 4.9 million fixed subscribers (50% less) and an optimistic upper case of 14.6 million fixed subscribers (50% more). We calculate the average annual benefits and aggregate benefits over a range of values in between the high and low values. Table 5 presents the annual and aggregate benefits for these cases – with the nominal case (9.7 million fixed subscribers) highlighted in bold.

Sensitivity to Number of Fixed Subscribers			
Subscribers	4.9 M	**9.7 M**	14.6 M
Average Annual Benefits	$310 M	**$620 M**	$930 M
NPV Aggregate Benefits	$2.6 B	**$5.2 B**	$7.8 B

Table 5. Sensitivity to Number of Subscribers

4. M2Z's Proposal to Provide Unrestricted Access to the Free Service Will Permit Public Safety Agencies to Develop An Interoperable Public Safety Network At Considerable Savings

M2Z will commit to provide unrestricted access to the M2Z Free Service to federal, state, or municipal public safety entities – including first responders – wherever M2Z services are available.[80] As with the basic M2Z Free Service available to consumers, the public

[80] *See Application*, Appendix 4, M2Z's Proposal to Serve Public Safety Entities.

safety free service will be free of airtime or service charges but will require the purchase of a compatible CPE to access the service.

U.S. public safety communications is comprised of thousands of separate communication systems independently funded, built and operated by local governments and agencies. Most of these systems use proprietary narrowband voice communications over dedicated infrastructure and spectrum. Individual systems generally cannot communicate with one another or facilitate interoperability.[81] The result is a "system of systems" that cannot interoperate across local political boundaries or sometimes even across agencies (such as police and fire) in the same jurisdiction.[82]

Many agencies have found it necessary to augment their public safety communications with commercial or municipally owned wireless services. [83] Many municipalities operate multi-use Wi-Fi networks to provide local data connectivity to police, fire, emergency response, utility and other public services.[84] Most commercially operated municipal Wi-Fi systems provide dedicated capacity at little or no cost for use by municipal agencies. In addition to Wi-Fi, many public safety agencies subscribe to commercial mobile phone and data services for use by fire, police and emergency medical service (EMS) units.

M2Z's commitment to provide free access will enable any public safety agency to develop a low cost basic (384 Kbps) IP-based data network using commercial off-the-

[81] Interoperability is defined as a communications link that permits units from different entities to interact with each other and exchange information. *See* Federal Communications Commission, *Report to Congress on the Study to Assess Short-Term and Long-Term Needs or Allocations of Additional Portions of the Electromagnetic Spectrum for Federal, State and Local Emergency Response Providers, Appendix B* at 1 (rel. Dec. 19, 2005) ("*Report to Congress*").

[82] When personnel from multiple public safety agencies arrived at Columbine High School after the shooting in 1999, interoperability problems were so great that they had to rely on runners to carry written messages from one agency's command center to another. (source: Peha)

[83] Many police and firefighters routinely carry cellular phones -- some at their own expense -- for use as backup when the official public safety system proves inadequate. After Hurricane Ivan hit Western Pennsylvania in 2004, flooding destroyed public safety communications equipment at the City of Carnegie Fire Department. First responders scrambled to fill the void by signing up for service with Nextel and Verizon Wireless, whose systems remained fully operational around the City of Carnegie. (see John Pehaa, "From TV to Public Safety, The Need for Fundamental Reform in Public Safety Spectrum and Communications Policy," New America Foundation, Working paper 15, October 2006.

[84] Supra note 65.

shelf equipment and software to provide functionality and specialized applications.[85,86] Each data network would augment the existing agency public safety communications system, while providing much needed interoperability with other public safety IP data networks nationwide (whether or not based on M2Z's network).

Public Safety Users. SAFECOM has estimated approximately 2,500,000 first responders in the U.S., in addition to about 62,000 local public safety departments and agencies and about 35,000 government agencies with public safety responsibilities (Table 6 below).[87]

First Responders	Local Agencies	Government Agencies
960,000 Firefighters	28,495 Fire Departments	25,763 Local Agencies
830,000 EMS Personnel	5,841 EMS Departments	6,396 State Agencies
710,000 Law Enforcement Officers	27,496 Law Enforcement Agencies	2,967 Federal Agencies
2,500,000 Personnel	**61,832 Departments and Agencies**	**35,126 Agencies**

Table 6. Public Safety Users

Each of these could be a potential user of an M2Z-based data network used to augment their primary mission-specific communications. Laptop computers, PDAs and other mobile devices equipped with M2Z compatible CPE could be used to provide data connectivity among first responders, fixed public safety locations and facilities deployed in the field, such as police cars, fire trucks and ambulances.

M2Z will not be the only provider of free broadband service to public safety agencies and

[85] The desired functionality could include features such as priority access, emergency alert, virtual private networks (VPNs), data conferencing and other specialized applications. Many of these applications can be enabled with commercially available software.

[86] Commercially available software is also available to implement a Wi-Fi based mesh network. A mesh network promotes a peer-to-peer connectivity with other devices in the network, and in the event that network infrastructure is unavailable or compromised, fixed network infrastructures such as base stations or access points are not required in order to provide communications between devices.

[87] Source: http://www.safecomprogram.com.

first responders. As noted above, many municipalities operate multi-use Wi-Fi networks that support public safety and other public services. In addition, many commercially operated municipal Wi-Fi networks, as part of their franchise agreement, dedicate a portion of their capacity for municipal use, which in turn is used to support public safety and other public services. Due to the fragmented nature of the public safety community, absent a coordinated effort to deploy a commercially based public safety data network, public safety agencies will decide individually whether and when to adopt the M2Z Free Service. Taking the alternate sources into account, we estimate that M2Z could gain a share of about one-half of the approximately 2.6 million public safety users -- or about 1.3 million users.

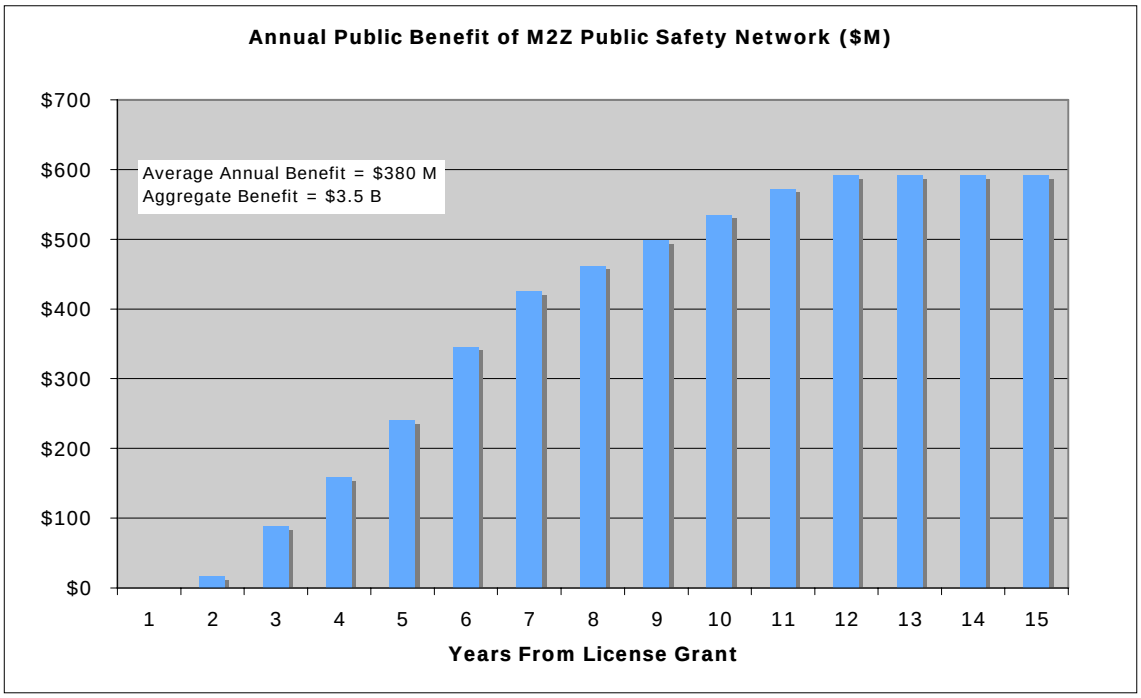
Public Benefits. The general public will benefit from public safety adoption of the M2Z Free Service since public safety agencies would avoid the high cost of commercial wireless broadband subscriptions. There clearly is an advantage for public safety agencies who currently use or plan to se commercial wireless data systems to adopt the Free Service and avid the cost of commercial services. We assume that public safety agencies would adopt the Free Service as it becomes available in their area. There will be a one-time cost of the CPE – specifically a PCMCIA wireless data card for agency laptop computers , PDAs and other portable devices.

The public benefits in any one-year can be calculated as the product of: (1) the savings per broadband line; and (2) the average number of public safety users passed by M2Z.[88] We include the cost for a public safety user to subscribe, which is the cost of the CPE (PCMCIA wireless data card). We estimate the public safety savings over the 15-year license term.[89] We hold constant the number of potential public safety users as shown in Table 3. We assume that nomadic access will be provided to each local department and agency and to each government agency. This is a total of about 1.3 million public safety users. We assume that the avoided cost of subscribing to a commercial service is about

[88] Supra note 35 and accompanying text.
[89] Supra note 47 and accompanying text.

$40 or more per month.[90] The estimated annual flow of savings is shown in Figure 5.[91]

Figure 5. Public Benefit of M2Z Public Safety Network



Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	$0	$16	$87	$158	$240	$346	$425	$462	$499	$535	$572	$592	$592	$592	$592

The public benefit will grow as the network is deployed and more public safety users are passed. The average annual benefit over the 15-year license term is about $380 million. The NPV of the aggregate benefits is about $3.5 billion.[92]

Note that the public benefits could be greater since we do not take into account any projected growth in public safety users -- and have assumed that agency and department fixed locations could be served by only one subscription.

[90] Mobile wireless broadband data services such as evolution-data optimized (EV-DO) and high-speed downlink packet data access (HSDPA) that currently retail for $60 to $80 per month for unlimited usage. We assume that public safety agencies can negotiate a discount.
[91] Appendix D presents the details of the calculations underlying the analysis.
[92] Supra note 50.

Sensitivity to the number of public safety users. We examine the sensitivity of the above analysis to the number of public safety users.

Sensitivity to Number of Public Safety Users			
Public Safety Users	650 K	**1.3 M**	1.9 M
Average	$190 M	**$380 M**	$570 M
Aggregate	$1.7 B	**$3.5 B**	$5.2 B

Table 6. Sensitivity to Number of Public Safety Users

5. M2Z's Commitment to Pay A Spectrum Usage Fee Would Generate Revenues for the Treasury and Added Social Benefits Through the Reduction of Taxes

M2Z will commit to pay to the U.S. Treasury a "usage" fee of five percent of the gross revenues derived from the Premium Service. This annual fee will generate revenues for the Government that will serve in effect to reduce he need for taxes.

Market. At the BOY 2009, we estimate about 117.4 million households and 74.4 million broadband households (63.3% penetration). Over the 15-year license term, we assume that household broadband penetration will ultimately reach 85% of U.S. households. At the end of the license term in 2023, we project about 140.2 million households and about 119.1 million broadband households.[93] Thus, during the 15-year license term, we expect about 35 million households will enter the market for broadband access -- in addition to the 9.7 million subscribers to the M2Z Free Service.

M2Z will compete primarily with telephone companies (DSL) and cable companies (cable modem) for a share of the new consumer residential broadband market. Other

[93] Projection based upon U.S. Census data and historical annual growth rate of 1.19 % (1.187%).

fixed wireless companies, municipal wireless and perhaps power line broadband providers will provide residential broadband in limited geographical areas of the country. It is also possible that a new national wireless competitor would emerge with a similar business plan – offering both a free and a paid subscription service. Taking potential competition into account, we estimate that within the 15-year license term, the M2Z Premium Service could ultimately garner a share of about one-fifth of the 35 million new broadband households– about 7.0 million residential subscribers.

We estimate the wholesale price of the M2Z Premium Service at about $22 per month. To arrive at this figure we reduce the average broadband price of $37 by 10%, the result of M2Z's entry into the market.[94] We then estimate the wholesale price at about two-thirds of the retail price (i.e. 50% markup by reseller).

Since M2Z provides portability, it will also compete for a share of the emerging mobile broadband market. Mobile wireless carriers using variants of 3G and 3.5G technologies (e.g. EV-DO and HSDPA) are offering broadband Internet access in limited geographic areas. Business or enterprise users are the most likely customers for these services – currently consumer demand for broadband outside the home is low and price sensitive.[95] Several carriers are planning to deploy mobile WiMax networks offering even higher data rates, again in limited geographic areas.[96] A number of mobile applications for business and consumers are now being introduced in addition to Internet links, such as TV broadcast, streaming video and mobile commerce (m-commerce). Similarly, Wi-Fi enabled nomadic devices are capable of offering broadband speeds. As a result we expect consumer demand for mobile Internet access will continue to increase. The development of a mobile broadband market for consumers and business will present additional opportunities for a cheaper and more ubiquitous nomadic broadband service.

[94] Supra note 35 plus accompanying text.
[95] Supra note 69 plus accompanying text.
[96] Sprint Nextel plans to begin deploying in 2008 a mobile Wi-Max network to cover up to as many as 100 million people in the top 100 U.S. markets. This would represent about 33% coverage of the U.S. population.

However, is not clear to what extent consumers will adopt portable or mobile broadband services in any number in the future.

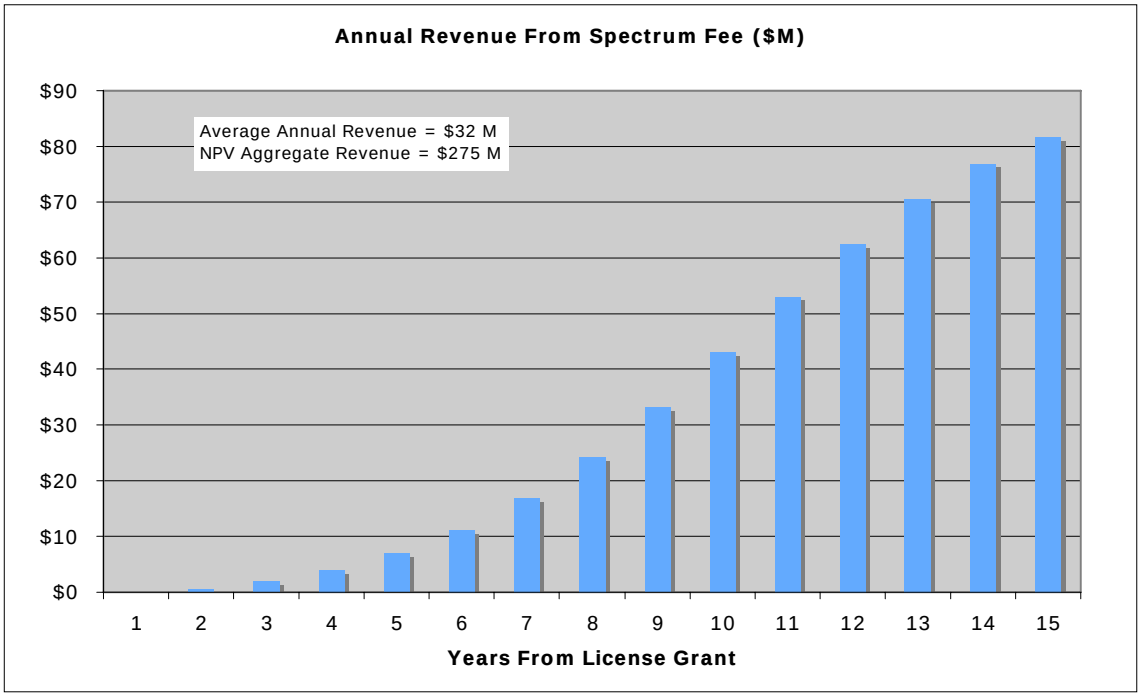
Revenue from Spectrum Fee. The spectrum fee is five percent of the M2Z's gross revenues from the Premium Service. The gross revenues is the product of: (1) the wholesale price of the Premium Service; and (2) the number of consumers that subscribe to the Premium Service. The number of consumers that adopt the Premium Service is the product of the 7.0 million ultimate market and the M2Z adoption curve.

We estimate the revenue from the spectrum fees over the 15-year license term.[97] We hold constant the monthly wholesale price of $22. The estimated annual flow of spectrum fees paid to the Treasury is shown in Figure 6.[98]

The revenue to the Treasury grows as the network is deployed and consumers adopt the Premium Service. The average annual spectrum fee over the 15-year license period is about $32.4 million per year. The NPV of the annual flow of spectrum fees would be about $275 million.[99]

The total revenue from spectrum fees would be even greater since we have not assumed M2Z would take any market share from competing service providers. To the extent that subscribers churn from DSL, cable modem or other service providers, then the revenue estimates would be conservative. We also expect that the total fees paid would be even greater since we have not considered nomadic users. Adoption of M2Z Premium by nomadic users in the future would also result in a considerably greater flow of spectrum fees.

[97] Supra note 47 and accompanying text..
[98] Appendix D presents the details of the calculations underlying the analysis.
[99] Supra note 50 .



Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	$0	$1	$2	$4	$7	$11	$17	$24	$33	$43	$53	$62	$71	$77	$82

Figure 6. Revenue from Annual Spectrum Fee

Sensitivity analysis. We examine the sensitivity of the above analysis to the number of fixed subscribers. We consider a conservative lower case of 3.5 million fixed subscribers (50% less) and an optimistic upper case of 10.5 million subscribers (50% more). We calculate the average annual spectrum fee and aggregate spectrum fee over a range of values between the high and low values. Table 7 presents the analysis. The nominal case (7.0 million fixed subscribers) is highlighted in bold.

Sensitivity Analysis -- Revenue from Spectrum Fee			
Subscribers	3.5 M	**7.0 M**	10.5 M
Average Annual Benefits	$16.2 M	**$32.4 M**	$48.6 M
NPV Aggregate Benefits	$138 M	**$275 M**	$413 M

Table 7. Sensitivity Analysis –Revenue From Spectrum Fees

Public benefits due to reduction of taxes. The general public will realize indirect benefits from unbudgeted payments to the Treasury, which in effect reduce the budgetary demand for taxes. Taxes impose an excess burden or a deadweight loss on the economy, affecting choices made by both consumers and producers.[100] Reduction in taxes reduces this burden and thus improves economic welfare.[101]

While estimates of the welfare effects of reduced taxation vary considerably, a number of estimates suggest that the marginal gain would be equal to about $0.40 for each dollar of reduced tax revenue.[102] Hausman has estimated the marginal efficiency loss (gain) from general federal income taxes at $0.405 for each additional dollar collected.[103] Using this estimate, each dollar of spectrum fee contributed to the Treasury would result in a total of $1.40 in public benefits.

6. FCC Delay or Failure to Authorize the M2Z Service Would Harm Consumers and Cause an Irrecoverable Loss of Consumer Benefits

The estimates of the value of the public benefits of M2Z's proposal assume no delay in granting a license. We assume that M2Z receives a spectrum license by the beginning of 2008 so that service can commence by the beginning of 2009. Beginning in 2009, the consumer benefits increase as M2Z builds out its network over time. A delay in building out the network would push the flow of consumer savings into the future and, given the time value of money, adversely affect consumer welfare.

---

[100] Deadweight loss is defined as the net loss in economic welfare that is caused by a tax or other source of distortion (such as tariffs, subsidies, non-tariff barriers, imperfect competition etc.).

[101] Richard K. Vedder and Lowell E. Gallaway, "Tax Reduction and Economic Welfare," Prepared for the Joint Economic Committee, April 1999.

[102] Ibid.

[103] Jerry Hausman, "Efficiency Effects on the U.S. Economy from Wireless Taxation," National Tax Journal, Vol. LIII, No. 3, Part 2, pp 739-740; Jerry Hausman, "Income and Payroll Tax Policy and Labor Supply'" The Supply Side Effects of Economic Policy, edited by Lawrence Meyer, St. Louis: St. Louis Federal Reserve, 1981; Hausman, J. "Taxation By Telecommunications Regulation," *Tax Policy and the Economy*, 12, 1998.

We estimate the losses in consumer benefits from delayed entry by comparing the estimated consumer benefits if entry occurs in 2009 (no delay scenario) to the estimated consumer benefits if entry occurs at a later time (delay scenario). The reduction in consumer benefits caused by the delay is the difference between the two flows of consumer benefits.

We assume that M2Z will build out and consumers will adopt the service at the same rate in the delay scenario as in the no delay scenario. Thus, the flow of consumer savings will be shifted to the right by the number of years of delay – i.e. a one-year delay would shift the flow of consumer savings by one year. We conservatively focus solely on delay, assuming that delay has no effect on the rate of entry and market penetration.

Using the above analytical framework and assumptions, we estimate the consumer benefits that would be lost due to a delay in start of operations. Tables 8 and 9 show the effect of a delay on our estimates of average consumer benefits and aggregate consumer benefits.

Average Annual Consumer Benefits Lost From Delayed Entry				
	Years Delay			
	0	**1**	**2**	**3**
Competition	$2.8 B	$2.5 B	$2.2 B	$1.9 B
M2Z Free Service	$620 M	$511 M	$408 M	$315 M
Public Safety	$381 M	$341 M	$302 M	$262 M
Spectrum Fee	$32 M	$27 M	$22 M	$17 M
Total	$3.8 B	$3.4 B	$2.9 B	$2.5 B

Table 8. Average Annual Consumer Benefits Lost From Delayed Entry

Aggregate Consumer benefits Lost From Delayed Entry				
	Years Delay			
	0	1	2	3
Competition	$25.2 B	$22.1 B	$19.1 B	$16.2 B
M2Z Free Service	$5.2 B	$4.2 B	$3.3 B	$2.5 B
Public Safety	$3.5 B	$3.0 B	$2.6 B	$2.2 B
Spectrum Fee	$275 M	$225 M	$179 M	$138 M
Total	$34.2 B	$29.5 B	$25.2 B	$21.0 B

Table 9. Aggregate Consumer Benefits Lost From Delayed Entry

As shown above, the loss in benefits due to a delay can be substantial. Just one year of delay reduces the average annual consumer benefits from competition by about $300m and the aggregate value by over $3 billion. The average annual value of consumer benefits from the M2Z Free Service is reduced by about $110 million and the aggregate value by about $1.0 billion. The total average losses due to a one year delay are about $400 million a year -- and the total aggregate losses are about $4.7 billion. Moreover, losses in consumer benefits due to delay are irrecoverable. For example, if a household pays more for broadband service in 2010 because policymakers have delayed granting a license, then that money is lost forever and cannot be recovered, even if the license is granted later. The household will never get that money back, even if it enjoys lower prices in future years.

7. The Substantial Recurring Public Benefits of the M2Z Proposal Would Far Outweigh the Cost of Authorizing the Service

Consumers and the general public would realize significant benefits following the FCC's grant of M2Z's license application. Over the 15-year term of the license:

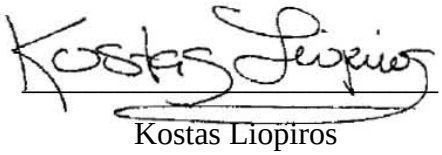
- M2Z would provide a national facilities-based broadband competitor, benefiting consumers through lower prices, enhanced services and expanded choices. We estimate the average annual benefits to be about $2.8 billion per year, with an aggregate value of over $25 billion, both in year 2009 dollars.

- M2Z's commitment to provide a basic M2Z Free Broadband Service with content filtering will accelerate the adoption of broadband by providing affordable broadband to consumers who cannot afford existing offerings. We estimate the average annual benefits to be about $620 million per year with an aggregate value greater than $5 billion, both in year 2009 dollars.

- M2Z's commitment to provide unrestricted free access to all public safety entities will benefit the general public by enabling public safety agencies to develop low-cost, commercially based data networks to augment their existing public safety networks, while deferring the substantial cost of access. We estimate that the average annual benefits to be about $380 million per year with an aggregate value of about $3.5 billion, both in year 2009 dollars.

- M2Zs commitment to pay a spectrum usage fee will benefit the general public by generating additional and unbudgeted revenues for the Treasury. We estimate that M2Z would provide to the Treasury an average revenue of over $32 million per year, with an aggregate value of about $275 million, both in year 2009 dollars.

In total, American consumers and the public will experience average annual benefits of $3.8 billion, and aggregate consumer benefits over the 15-year term of the license would amount to $32.4 billion. These estimates assume that M2Z would be granted a spectrum license in a timely fashion enabling commencement of operations by the beginning of 2009. Any factor that delays entry would harm consumers and cause a substantial and irrecoverable loss of benefits. A one-year delay in M2Z's entry into the market would result in total average losses of about $400 million per year -- and total aggregate losses of $4.7 billion.



Kostas Liopiros

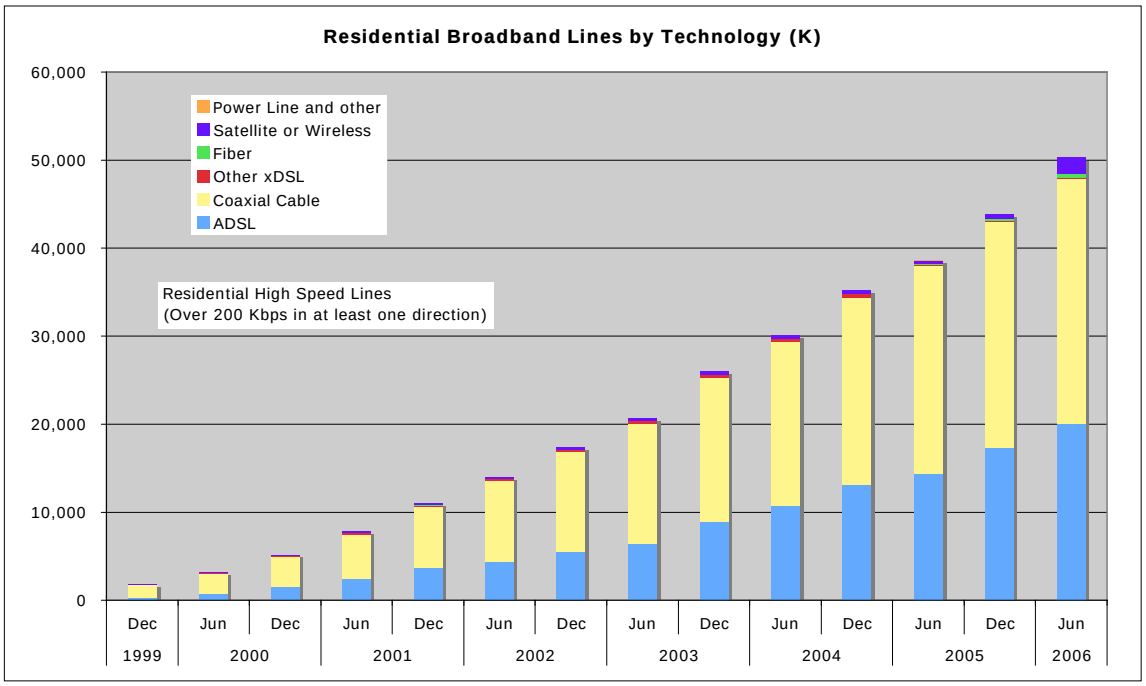
3/19/2007

March 19, 2007

APPENDIX A

PENETRATION OF INTERNET AND BROADBAND

Broadband. For broadband, we use the FCC definition of a high-speed line as a connection that delivers services at speed exceeding 200 kilobits per second (Kbps) *in at least one direction*. Figure 1 below is a compilation of the FCC data on *residential and small business* high-speed connections (at least one direction greater than 200 Kbps) for the years 1999 (the first year reports were available) through 2005.[104]



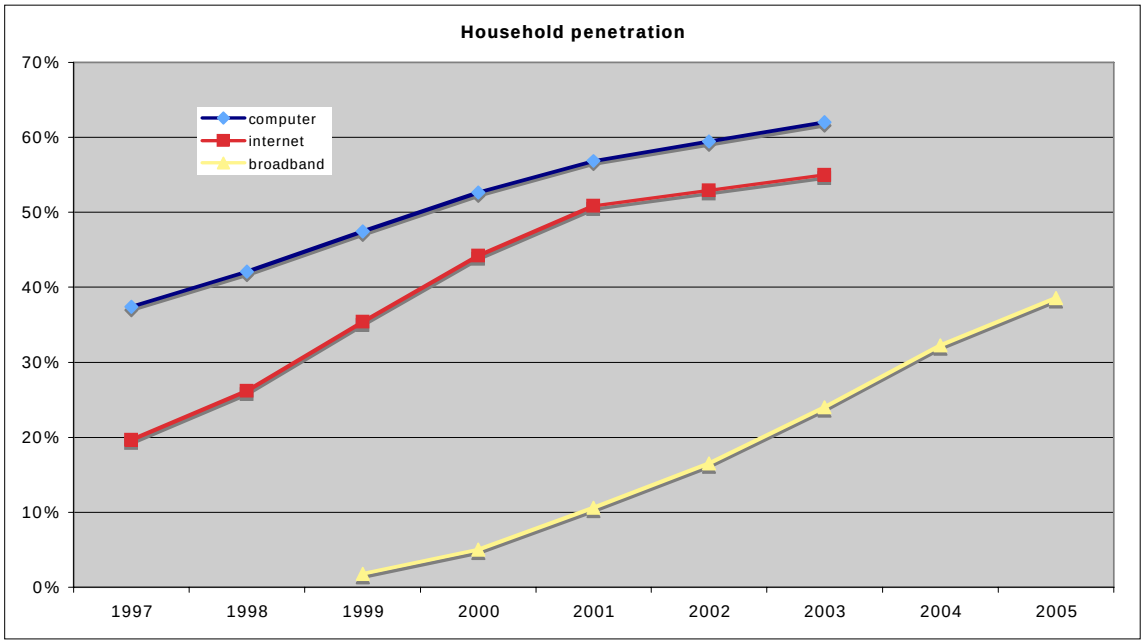
	1999	2000		2001		2002		2003		2004		2005		2006
	Dec	Jun	Dec	Jun	Dec	Jun	Dec	Jun	Dec	Jun	Dec	Jun	Dec	Jun
ADSL	292	772	1,595	2,491	3,616	4,395	5,529	6,430	8,909	10,759	13,119	14,443	17,371	20,143
SDSL/ traditional wireline	47	111	177	138	140	224	213	250	290	393	419	159	129	112
coaxial cable	1,402	2,215	3,295	4,999	7,051	9,157	11,343	13,661	16,416	18,525	21,270	23,497	25,625	27,720
fiber	1	0	2	3	4	6	15	16	20	23	35	83	213	442
satellite or wireless	50	64	102	182	195	202	257	289	342	388	423	428	533	1,839
power line and other												4	5	5
total lines	1,792	3,164	5,170	7,812	11,005	13,984	17,357	20,646	25,977	30,088	35,266	38,615	43,877	50,262

Figure A-1. U.S. Broadband Lines by Technology

[104] These data are compiled from the bi-annual series of FCC reports: High-Speed Services for Internet Access, which include data on high speed access from June 30, 2000 through June 30, 2006.

Internet. The PEW/INTERNET surveys show that Internet penetration in the U.S. has reached 73% of American adults (about 147M adults) in 2005.[105] In this survey, Internet users include those who at least occasionally use the Internet or send and receive e-mail. This includes Internet users that access the Internet at work but not at home. Internet penetration of U.S. households is less.

Up-to-date on Internet penetration of households is harder to obtain. The Census Bureau's population survey data shows that in October 2003 54.6% of U.S. households had Internet connections -- up from 8.6% in October 1997.[106] The household penetration of Internet and broadband services through the end of 2005 is plotted in Figure A-2 below.



	1997	1998	1999	2000	2001	2002	2003	2004	2005
computer	37.4%	42.1%	47.4%	52.6%	56.8%	59.4%	62.0%		
internet	19.7%	26.2%	35.4%	44.2%	50.8%	52.9%	54.9%		
broadband			1.8%	5.0%	10.6%	16.6%	24.0%	32.3%	38.6%

Figure A-2. Household penetration of computer, Internet and Broadband

[105] Internet Penetration and Impact, PEW/INTERNET and American Life Project, April 2006

[106] A Nation Online: ENTERING THE BROADBAND AGE, U.S. Department of Commerce, September 2004. See also Computer and Internet Use in the United States: 2003, Current Population Reports, US Census Bureau, October 2005.

Forecast. We estimate Internet and broadband penetration at EOY2008/BOY 2009 by fitting an S-shaped Bass curve to the historical data in Figure A-2 and using the Bass coefficients to forecast the adoption rate for EOY 2008.[107] In doing so, we assume that in the long term, Internet household will reach about 95% of households -- about the level of telephone penetration.[108] We assume that in the long term, broadband penetration would reach about 85% of households. We estimate narrowband household penetration as the difference between Internet and broadband household penetration. The projected penetration for the EOY 2005 and the EOY 2008 are shown in Table A-1 below.

U.S. Internet and Broadband Penetration		
	EOY 2005	**EOY 2008**
Population	296.7 M	306.0 M
Households	113.3 M	117.4 M
Internet penetration	71.6%	83.0%
Internet households	81.2 M	97.4 M
Non-Internet households	32.2 M	20.0 M
Broadband penetration	37.9%	63.3%
Broadband households	42.9 M	74.4 M
Narrowband penetration	33.7%	19.7%
Narrowband households	38.2 M	23.1 M

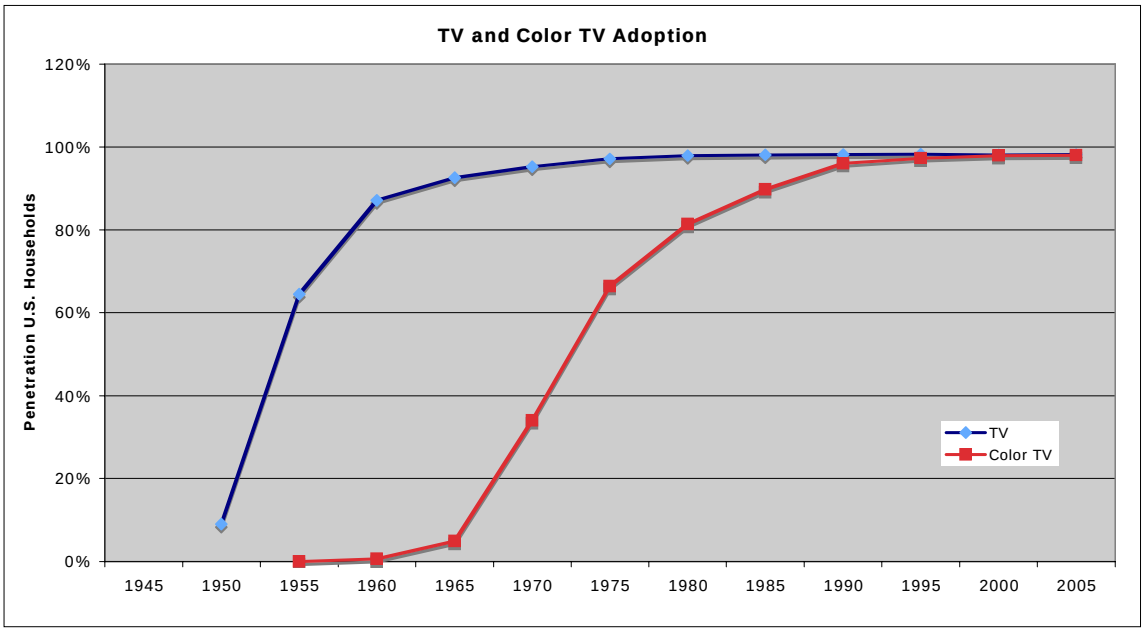
Table A-1. Internet and Broadband Penetration

[107] See Appendix C for a discussion of using the Bass curve to forecast the adoption of new services and products.
[108] U.S. Census Bureau, Statistical Abstract of the United States, 2006, Table 1117.

APPENDIX B

CONSUMER ADOPTION OF NEW PRODUCTS AND SERVICES

Historically, *consumer* adoption of new technologies and services has followed an S-curve. When a new technology or service is first introduced, the number of users that adopt the technology is low and the penetration rate is low. From this small base, the number of users increase and the rate of growth accelerates. Beyond the middle of the S-curve, the total number of users and penetration will continue to increase, but less rapidly. Finally, the number of users and penetration rate will approach a level that saturates the market for that technology. Figure B-1 shows the historical adoption data for television (TV) and color TV. Adoption is calculated as a percentage of U.S. households.[109]

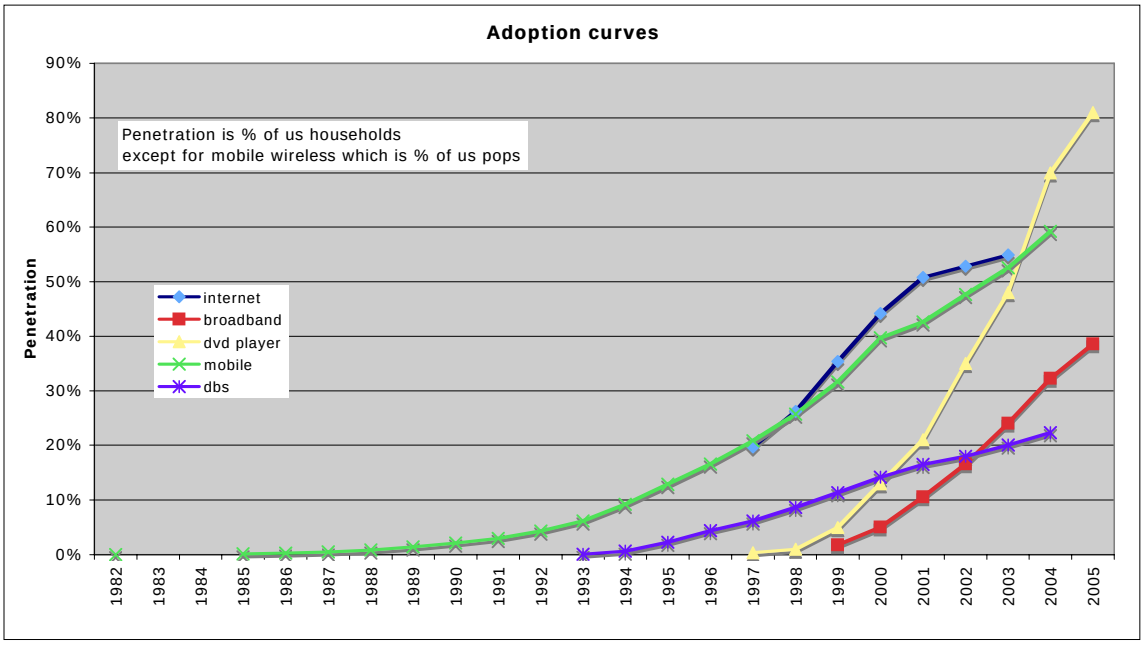


	1945	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
TV		9.0%	64.5%	87.1%	92.6%	95.3%	97.1%	97.9%	98.1%	98.2%	98.3%	98.2%	98.2%
Color TV			0.0%	0.6%	4.9%	34.0%	66.4%	81.3%	89.7%	96.1%	97.3%	98.0%	98.1%

Figure B-1 Adoption Curves -- TV and Color TV

[109] Data on TV households from TV Basics at http://www.tvb.org.

For many technologies, this process often takes a few decades before the S-curve reaches its mature level. For example, it took about six decades before the telephone reached its current penetration level of about 95% of households. It took over two decades for television to reach its saturation level of about 98 % of households. In contrast, consumers have adopted consumer electronics and Internet related technologies at much higher rates. Figure B-2 shows the historical adoption data for selected consumer electronics and Internet technologies.[110] As before, adoption is calculated as a percentage of U.S. households, except for mobile telephony, which is a percentage of U.S. population.



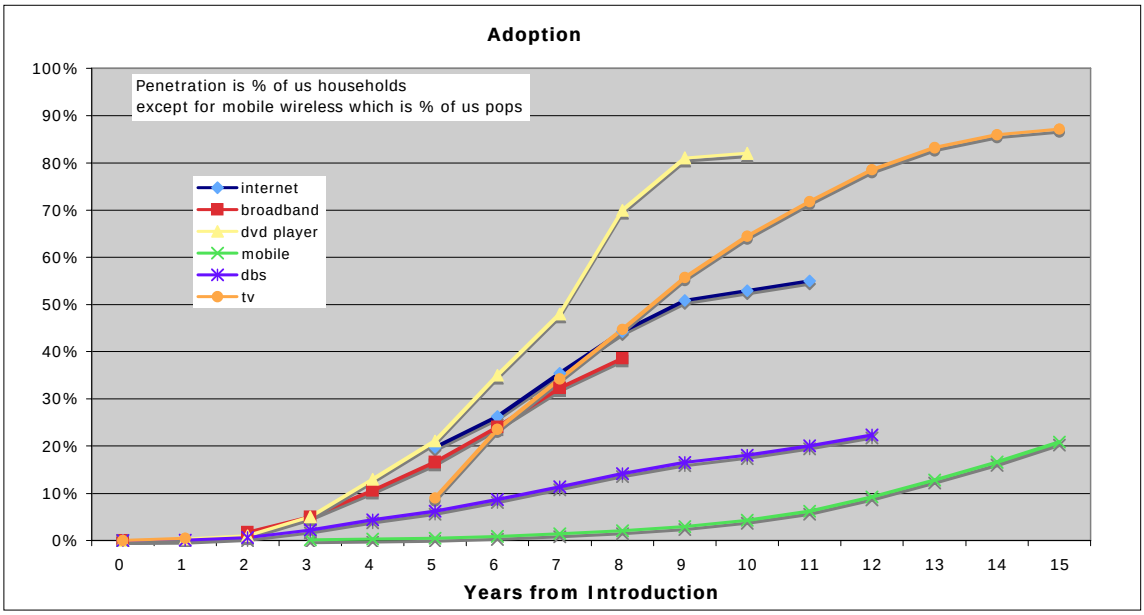
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
internet																19.7%	26.2%	35.4%	44.2%	50.8%	52.9%	54.9%		
broadband																		1.8%	5.0%	10.6%	16.6%	24.0%	32.3%	38.6%
dvd player																0.4%	1.0%	5.0%	13.0%	21.0%	35.0%	48.0%	70.0%	81.0%
mobile	0.0%			0.1%	0.3%	0.5%	0.8%	1.4%	2.1%	3.0%	4.3%	6.2%	9.2%	12.8%	16.6%	20.8%	25.7%	31.6%	39.7%	42.6%	47.7%	52.5%	59.3%	
dbs												0.1%	0.6%	2.3%	4.4%	6.2%	8.7%	11.4%	14.1%	16.5%	18.0%	20.0%	22.3%	

Figure B-2. Adoption Curves – Consumer Electronics and Internet

[110] Data on consumer electronics compiled from several sources including TV Basics at http://www.tvb.org., Consumer Electronics Association at http://www.ce.org, the FCC Annual Video reports and CMRS Reports and CTIA.

All of the adoption curves here exhibit various stages of a classic S-shaped pattern where sales start out slowly, then pick up momentum and eventually decline as a saturation level is approached.

Finally, we compare the first 15 years of the adoption data in Figure B-3.



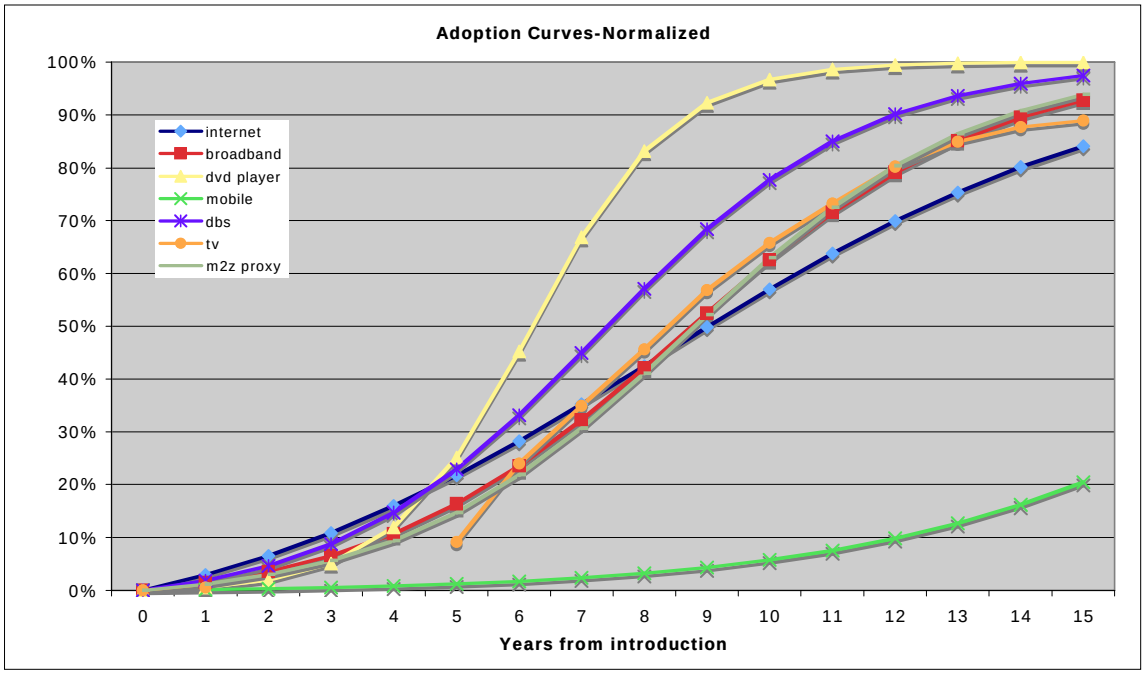
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
internet	0.0%					19.7%	26.2%	35.4%	44.2%	50.8%	52.9%	54.9%				
broadband	0.0%		1.8%	5.0%	10.6%	16.6%	24.0%	32.3%	38.6%							
dvd player	0.0%	0.4%	1.0%	5.0%	13.0%	21.0%	35.0%	48.0%	70.0%	81.0%	82.0%					
mobile	0.0%			0.1%	0.3%	0.5%	0.8%	1.4%	2.1%	3.0%	4.3%	6.2%	9.2%	12.8%	16.6%	20.8%
dbs	0.0%	0.1%	0.6%	2.3%	4.4%	6.2%	8.7%	11.4%	14.1%	16.5%	18.0%	20.0%	22.3%			
tv	0.0%	0.5%				9.0%	23.5%	34.2%	44.7%	55.7%	64.5%	71.8%	78.6%	83.2%	85.9%	87.1%

Figure B-3. Historical Adoption Curves -- Years from Introduction

As is the case with consumer electronics and wireless technologies, we expect the adoption of M2Z services to exhibit the classic S-shaped curve. We develop a proxy adoption curve by analogy with the adoption of TV and broadband in the U.S. However, we expect that M2Z would exceed the adoption rate exhibited by broadband in the U.S. Adoption of M2Z will be driven by increasing consumer awareness and pervasiveness of the Internet and broadband applications, As well as being fueled by the low cost of

adopting the M2Z Free Service, competitive pricing for the Premium Service and the ease of provisioning.

In Figure B-4 we show the normalized adoption curves for each technology extrapolated out to 15 years by fitting a Bass Model to each curve.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
internet	0.0%	3.0%	6.6%	10.9%	15.9%	21.7%	28.2%	35.2%	42.5%	49.8%	57.0%	63.8%	69.9%	75.4%	80.1%	84.1%
broadband	0.0%	1.5%	3.6%	6.6%	10.7%	16.3%	23.5%	32.2%	42.1%	52.5%	62.6%	71.6%	79.1%	85.1%	89.5%	92.8%
dvd player	0.0%	0.6%	1.9%	5.1%	11.9%	25.2%	45.2%	66.8%	83.1%	92.3%	96.7%	98.6%	99.4%	99.8%	99.9%	100.0%
mobile	0.0%	0.1%	0.3%	0.5%	0.8%	1.2%	1.7%	2.4%	3.2%	4.3%	5.7%	7.6%	9.8%	12.7%	16.2%	20.4%
dbs	0.0%	1.8%	4.6%	8.8%	14.7%	22.9%	33.1%	44.9%	57.1%	68.4%	77.8%	85.0%	90.1%	93.6%	95.9%	97.4%
tv	0.0%	0.5%				9.2%	24.0%	34.9%	45.6%	56.8%	65.8%	73.3%	80.2%	84.9%	87.7%	88.9%
m2z proxy	0.0%	1.2%	3.0%	5.6%	9.4%	14.7%	21.8%	30.7%	41.1%	52.1%	62.9%	72.5%	80.3%	86.3%	90.7%	93.8%

Figure B-4. Normalized Adoption Curves

The normalized proxy M2Z adoption curve is given by the Bass Curve equation, where p=0.010 and q=0.426 (see Appendix C). The M2Z proxy adoption curve generally follows the adoption curves for broadband and for TV -- and shows the cumulative percentage of the ultimate market that is adopted over time. As with other adoption curves, the rate of adoption for the first few years is relatively low, with growth taking off after about four years after introduction.

APPENDIX C

FORECASTING THE SALE OF NEW PRODUCTS AND SERVICES

The Bass model for forecasting first purchase has had a long history in marketing. It is most appropriate for forecasting sales of an innovation (more generally a new product) for which no closely competing alternatives exist in the marketplace. Such forecast for new technologies or major product innovations are often used before investing significant resources.

The Bass model offers a good starting point for forecasting the long-term sales pattern of new technologies and new durable products. The model attempts to predict how many customers will eventually adopt the new product and when they will adopt. The question of when is particularly important because answers to this question guide the firm in its deployment of resources in marketing the innovation.

The Bass diffusion model describes the process how new products get adopted as an interaction between users and potential users. The model is widely used in forecasting, especially product forecasting and technology forecasting.[111]

The Bass model can represent the S-shaped growth pattern and quantify the speed of diffusion with three easily interpretable parameters:

- p the coefficient of innovation (or coefficient of external influence);
- q the coefficient of imitation (or coefficient of internal influence); and
- m the total number of customers in the adopting target market, all of whom will eventually adopt the target

[111] Frank Bass, "A new product growth for model consumer durables", Management Science 15, no. 5, 1969, pp215-227.

The parameters p and q determine the speed of the diffusion. A high value for p indicates that the diffusion has a quick start but also tapers off quickly. A high value of q indicates that the diffusion is slow at first but accelerates after a while. Thus if q > p, then imitation effects dominate the innovation effects and the plot of N(t) will have the classic S-shaped curve. This is the case for most consumer electronics and mobile wireless. It is also true for products and technologies that exhibit network effects (like the VCR and fax machine) or require heavy investments in complementary infrastructure by suppliers (like television or cellular telephone). If q < p, then innovation effects will dominate and the highest sales will occur at introduction and decline every period after that. If both p and q are large, then product sales take off rapidly and fall off quickly after reaching a maximum -- resulting again in an S-shaped curve. Thus, by varying p and q, the Bass curve can be fitted to most empirical product adoption data.

The model can also be used to forecast future adoption using the following formula"

$$N(t) = m \times \left[1 - e^{-(p+q)t}\right] / \left[1 + (q/p)e^{-(p+q)t}\right]$$

where *N(t)* is the total number of people that have adopted at time t.

By identifying previous innovations that are analogous to the product in question, we can determine the parameters p and q from an analysis of the sales data of those previous innovations. By combining this with an estimation of m, the total number of customers ultimately adopting the innovation, we can forecast the sales pattern for the new product.

The Bass model has been used for understanding how successful innovations have diffused through the population and increasingly for forecasting future product adoptions. This is the same approach used successfully to forecast the adoption of DirecTV and other new innovative products.[112]

[112] The DirecTV forecasts were made in 1992, two years before the anticipated launch of the product. The eventual number of adopters, m, was estimated through a national survey of prospective customers. The values of p and q were determined by analogy to the adoption of cable TV, which was introduced in the early 1980s. The resultant forecasts turned out to be quite accurate. (see Lillien and Rangaswamy, Marketing Engineering, 2004.)

APPENDIX D

CALCULATION OF CONSUMER BENEFITS

- Benefits to Incumbent Subscribers from Competition
- Benefits to Subscribers of M2Z's Free Service
- Benefits to Incumbent Subscribers from Competition
- Benefits to Public Safety Agencies
- Spectrum Lease Payments to the U.S. Treasury

Benefits to Incumbent Subscribers over the 15-year license term due to M2Z Competition (2008 dollars)

Year	Residential Broadband Households (M)	M2Z Free Service Subscribers (M)	M2Z Premium Service Subscribers (M)	Incumbent Subscribers Households (M)	M2Z Buildout	Incumbent Subscribers Covered by M2Z (M)	Incumbent Subscribers Covered by M2Z (M) (Ave)	Incumbent Subscriber Savings (per month)	Total Annual Incumbent Subscriber Savings ($M)
2008	74.37	0.00	0.00	74.37	0.00%	0.00	0.00	$3.70	$0.00
2009	82.54	0.12	0.08	82.34	11.00%	9.06	4.53	$3.70	$201.07
2010	89.15	0.29	0.21	88.65	22.00%	19.50	14.28	$3.70	$634.06
2011	94.37	0.55	0.39	93.43	33.00%	30.83	25.17	$3.70	$1,117.45
2012	98.46	0.92	0.66	96.88	49.50%	47.96	39.39	$3.70	$1,749.10
2013	101.69	1.43	1.03	99.23	66.00%	65.49	56.72	$3.70	$2,518.59
2014	104.32	2.12	1.52	100.67	71.80%	72.28	68.89	$3.70	$3,058.65
2015	106.52	2.99	2.15	101.39	77.60%	78.68	75.48	$3.70	$3,351.30
2016	108.43	4.00	2.87	101.56	83.40%	84.70	81.69	$3.70	$3,627.04
2017	110.16	5.08	3.64	101.43	89.20%	90.48	87.59	$3.70	$3,889.07
2018	111.75	6.13	4.40	101.23	95.00%	96.17	93.32	$3.70	$4,143.54
2019	113.27	7.06	5.07	101.15	95.00%	96.09	96.13	$3.70	$4,268.10
2020	114.74	7.82	5.62	101.31	95.00%	96.24	96.17	$3.70	$4,269.73
2021	116.19	8.41	6.04	101.75	95.00%	96.66	96.45	$3.70	$4,282.38
2022	117.63	8.84	6.34	102.45	95.00%	97.33	96.99	$3.70	$4,306.47

average annual savings ($Million)	**$2,761.10**
npv savings ($Million)	**$25,247.10**

Benefis to Subscribers of M2Z Free Service over 15 year license term (2008 dollars)

Year	M2Z Service Adoption Curve	M2Z Free Service Subscribers (M)	M2Z Free Service Subscribers (Ave)	M2Z Free Service Subscriber Adds (M)	M2Z Subscriber Savings (per month)	Total Annual M2Z Subscriber Savings ($M)	CPE Cost per Subscriber Add	Total Annual CPE Cost ($M)	Content Filtering Savings per Subscriber Add	Total Annual Content Filter Savings ($M)	Annual Net Savings ($M)
2008	0.0%	0.00	0.00	0.00	$16.00	$0.00	$250.00	$0.00	$30.00	$0.00	$0.00
2009	1.2%	0.12	0.06	0.12	$16.00	$11.11	$212.50	$24.60	$25.50	$2.95	($10.53)
2010	3.0%	0.29	0.20	0.17	$16.00	$38.90	$180.63	$31.36	$21.68	$3.76	$11.30
2011	5.6%	0.55	0.42	0.26	$16.00	$80.18	$153.53	$39.37	$18.42	$4.72	$45.54
2012	9.4%	0.92	0.73	0.37	$16.00	$140.33	$130.50	$48.30	$15.66	$5.80	$97.83
2013	14.7%	1.43	1.17	0.52	$16.00	$225.50	$110.93	$57.35	$13.31	$6.88	$175.03
2014	21.8%	2.12	1.78	0.69	$16.00	$341.35	$94.29	$65.04	$11.31	$7.81	$284.11
2015	30.7%	2.99	2.56	0.87	$16.00	$490.77	$80.14	$69.45	$10.00	$8.67	$429.98
2016	41.1%	4.00	3.49	1.01	$16.00	$670.88	$68.12	$68.78	$10.00	$10.10	$612.20
2017	52.1%	5.08	4.54	1.08	$16.00	$871.29	$57.90	$62.42	$10.00	$10.78	$819.65
2018	62.9%	6.13	5.60	1.05	$16.00	$1,075.47	$50.00	$52.44	$10.00	$10.49	$1,033.51
2019	72.5%	7.06	6.59	0.93	$16.00	$1,265.66	$50.00	$46.62	$10.00	$9.32	$1,228.37
2020	80.3%	7.82	7.44	0.76	$16.00	$1,428.54	$50.00	$38.22	$10.00	$7.64	$1,397.97
2021	86.3%	8.41	8.12	0.59	$16.00	$1,558.19	$50.00	$29.31	$10.00	$5.86	$1,534.74
2022	90.7%	8.84	8.62	0.43	$16.00	$1,655.45	$50.00	$21.35	$10.00	$4.27	$1,638.37

average annual savings ($Million)	**$619.87**
npv savings ($Million)	**$5,199.71**

Benefits to Public Safety Agencies Subscribing to M2Z Free Service over 15 year license term (2008 dollars)

Year	M2Z Buildout	Public Safety Subscribers (M)	Public Safety Subscribers (Ave)	Public Safety Subscriber Adds	Public Safety Subscriber Savings (per month)	Total Annual Public Safety Subscriber Savings ($M)	CPE Cost per Subscriber Add	Total Annual CPE Cost ($M)	Annual Net Savings ($M)
2008	0.00%	0.00	0.00	0.00	$40.00	$0.00	$150.00	$0.00	$0.00
2009	11.00%	0.14	0.07	0.14	$40.00	$34.28	$127.50	$18.21	$16.07
2010	22.00%	0.29	0.21	0.14	$40.00	$102.84	$108.38	$15.48	$87.36
2011	33.00%	0.43	0.36	0.14	$40.00	$171.40	$92.12	$13.16	$158.24
2012	49.50%	0.64	0.54	0.21	$40.00	$257.10	$78.30	$16.78	$240.32
2013	66.00%	0.86	0.75	0.21	$40.00	$359.94	$66.56	$14.26	$345.68
2014	71.80%	0.93	0.89	0.08	$40.00	$429.43	$56.57	$4.26	$425.17
2015	77.60%	1.01	0.97	0.08	$40.00	$465.58	$48.09	$3.62	$461.96
2016	83.40%	1.08	1.05	0.08	$40.00	$501.73	$40.87	$3.08	$498.65
2017	89.20%	1.16	1.12	0.08	$40.00	$537.88	$34.74	$2.62	$535.27
2018	95.00%	1.23	1.20	0.08	$40.00	$574.03	$30.00	$2.26	$571.77
2019	95.00%	1.23	1.23	0.00	$40.00	$592.11	$30.00	$0.00	$592.11
2020	95.00%	1.23	1.23	0.00	$40.00	$592.11	$30.00	$0.00	$592.11
2021	95.00%	1.23	1.23	0.00	$40.00	$592.11	$30.00	$0.00	$592.11
2022	95.00%	1.23	1.23	0.00	$40.00	$592.11	$30.00	$0.00	$592.11

average annual savings ($Million)	**$380.59**
npv savings ($Million)	**$3,476.98**

Spectrum Lease Payments to U.S. Treasury over 15 year license term (2008 dollars)

Year	M2Z Service Adoption Curve	M2Z Premium Service Subscribers	M2Z Premium Service Subscribers (Ave)	Wholesale Price Premium Service (per month)	M2Z Annual Premium Service Revenue $M)	Spectrum Fee	Annual Lease Payments to U.S. Treasury
2008	0.0%	0.00	0.00	$22.00	$0.00	5%	$0.00
2009	1.2%	0.08	0.04	$22.00	$10.97	5%	$0.55
2010	3.0%	0.21	0.15	$22.00	$38.40	5%	$1.92
2011	5.6%	0.39	0.30	$22.00	$79.15	5%	$3.96
2012	9.4%	0.66	0.52	$22.00	$138.53	5%	$6.93
2013	14.7%	1.03	0.84	$22.00	$222.60	5%	$11.13
2014	21.8%	1.52	1.28	$22.00	$336.96	5%	$16.85
2015	30.7%	2.15	1.84	$22.00	$484.46	5%	$24.22
2016	41.1%	2.87	2.51	$22.00	$662.25	5%	$33.11
2017	52.1%	3.64	3.26	$22.00	$860.08	5%	$43.00
2018	62.9%	4.40	4.02	$22.00	$1,061.64	5%	$53.08
2019	72.5%	5.07	4.73	$22.00	$1,249.38	5%	$62.47
2020	80.3%	5.62	5.34	$22.00	$1,410.17	5%	$70.51
2021	86.3%	6.04	5.83	$22.00	$1,538.15	5%	$76.91
2022	90.7%	6.34	6.19	$22.00	$1,634.16	5%	$81.71

average annual revenue ($Million)	**$32.42**
npv revenue ($Million)	**$275.12**